TRIESTE'S NEW HARBOR.

With great ceremony the last stone was recently laid in the new harbor of Trieste. The work has taken fifteen years of hard labor, and has cost 14,600,000 florins. The want of a commodious harbor in the place of the small inner harbor and the exposed roadstead was long felt, and as early as 1862 the Southern Railway, the terminus of which is in Trieste, laid a set of plans before the Government. Years passed, and finally the plans were examined, and with various amendments received the royal sanction.

By running out three piers 700 feet long and from 250 to 275 feet broad the old roadstead on the northeast was transformed into three large inclosures of eighty-five acres of water surface and nearly two miles of length of quays. As a protection against the northwest, southeast and southwest winds, a pier 3,600 feet long, running parallel with the shore, has been constructed. It is 1,000 feet from the shore, 200 feet broad at the base, 60 feet on the surface, and 67 feet high. At 460 feet from its northeast end a pier 250 feet long was built at right angles, which give a protected entrance of 315 feet in width. All the three inclosed basins have from 26 to 43 feet depth of water.

Some idea may be formed of the difficulties to be overcome, occasioned by the unstable nature of the soil, from the fact that the quay walls, four metres thick, after sinking for a year began to slide forward, while the vacant space was at once filled up. The walls were reconstructed, and they withstood in 1878 the the two most fearful southwest storms on record in this century.

THE BRICKS OF CHALDEA.

The dwellers in the vast alluvial plains of Chaldea had only to stoop, to pick up an excellent modelling clay. Hence tiles and bricks, crude, fired or enameled, played an all important part in the construction and decoration of building and in the education of the Chaldean. Messrs. Perrot and Chipietz, in their "History of Art in Chaldea and Assyria," say:

"In its final condition as terra cotta it offered a chance of duration far beyond that of either wood or papyrus. Once safely through the kiln it had nothing to fear short of deliberate destruction * * * At Hillah, the town which now occupies a corner of the vast space once occupied by the streets of Babylon, bricks are found built into the walls to this day, upon which the Assyrian scholar may read as he runs the royal style and titles of Nebuchadnezzar."

Chaldea was the cradle of civilization and consequently of art. The country was almost without stone, and hence brick was invented to take its place in construction. The earliest bricks were rough dried and mixed with straw; but just when the kiln was introduced will never be known, but it must have been in constant use in Chaldea from a very early date. Babylonian bricks are about a foot square by 6 inches thick, and almost always have inscriptions stamped upon the beds. Bitumen was often, but not always, used for mortar, and at Kasr and Birs-Nimroud to this day fragments of wall are found which cannot be separated without breaking the bricks themselves. Roofs were almost flat with just sufficient slope to carry off the water, and when a roof of baked clay had disintegrated, the presence of large round stones suggest the fact that they were originally rolled out. In time stone facing was used to protect the brickwork. Drains were common and the arch and the dome were well known. In vault construction the bricks were most ingeniously shaped and molded to meet the requirements of the case.

Stone sculpture plays but a feeble part in Chaldean art; it was too costly and only used as facing slabs to cover the main brick wall; stucco and colored and enameled bricks took its place. The Babylonian enamel is quite bright and thick; and with brick, faced with this material, men and animals were built upon the surface of the walls, and inscriptions with letters two or three inches high. Sieges, battles, and campaigns were commemorated in this way.

They evidently had iron in abundance, at least as early as the tenth century B. C. It was found at Khorisbad, by M. Place, in the shape of hooks, chains, picks, mattocks and hammers, of excellent quality as to material; these tools had been arranged symmetrically along one side of the chamber explored by him, and formed a total oxydized mass estimated at 175 tons in weight. They used an iron core with bronze in a way we know nothing of at this day.

THEN AND NOW.

The traveler who now finds himself transported between the metropolis of New England and Hartford in a palatial railway coach, within the space of three hours, can hardly realize that in former times the same journey was a serious and tiresome trip, occupying nearly four days. Yet the difference between the two periods of time mentioned just about measures the progress of the past 100 years in the way of travel. It is claimed that the first stage and mail route in New England, and probably the first in the country, began operations 100 years ago. Capt. Levi Pease of Somers, Ct., and Reuben Sikes of Suffield had previously run a passenger conveyance between Somers and Hartford, a distance of twenty miles, and from this small beginning conceived a scheme of establishing a regular passenger and post route between Hartford and Boston. "Two convenient wagons" were secured, and on October 20, 1783, at 6 o'clock in the morning, they left Boston and Hartford respectively. Captain Pease drove the west bound stage, starting from "Sign of the Lamb," stopped over night at Martin's in Northboro', passing through Worcester the next day, and resting at Rice's in Brookfield. His route the third day took him through Palmer, and perhaps Wilbraham, to his home in Somers, and on the fourth day Hartford was reached. This route was followed through the winter and early spring, but in May, 1784. Springfield was made a station, and the river was crossed there or at Enfield. By the new arrangement the stages left Boston from the Lion, Marlboro' street; the first night was passed at Farmer's in Shrewsbury, and Spencer was reached the day following. Here on about the highest point between Boston and Springfield, the passengers were transferred to Sikes, who took them to Springfield, and here they probably again changed conductors for the Southward. The fare at this time was "four pennie per mile," or about $10 for the trip from Boston to Hartford.—*Boston Journal.*

HYDRAULIC MINING.

SAN FRANCISCO, Cal., Jan. 7.—Judge Sawyer, of the United States Circuit Court, rendered a decision to-day in the celebrated mining-débris case of Woodruff *vs.* The North Bloomfield Hydraulic Mining Company, granting a perpetual injunction against hydraulic mining, subject to modification if a practical plan shall be devised for abating the nuisance. The case involved the agricultural prosperity of the entire Sacramento Valley.

The counties affected by the injunction are Butte, Nevada, Placer, Yuba, Del Norte, Siskiyon, Trinity, and Sierra—especially the four first named. During the last six years hydraulic mining has practically stopped in these counties. Farming counties through which the rivers were filled with "slickens," as the débris is called, fought the miners in court and obtained temporary injunctions.

The destruction which "slickens" has wrought on the fertile bottom lands is almost inconceivable. It filled the Yuba, Feather, and Sacramento Rivers, raised their beds until higher than the surrounding land, flooding the country for miles, submerging Sacramento City and Marysville. Notwithstanding the high levees built around cities along the Yuba river, over twenty-five square miles of farming lands, worth as high as $100 an acre, have been buried to a depth of from a foot to ten feet and over. The bed of Feather River at Marysville has risen fifteen feet, at Sacramento fully six feet. The harbor of San Francisco and the water-front on the navy-yard at Mare Island have also been seriously injured. Three years ago brush dams were erected with a view of holding back the débris, but one freshet carried many away and fire destroyed the remainder, involving a loss of half a million dollars.

The capital invested in hydraulic mining is principally from England. Congress is chiefly at fault for permitting the progress to go on for years unchecked, and it is difficult to prophesy when the Supreme Court of the United States, whence the case will be appealed, will decide. It is money thrown away for Congress to make appropriations for the improvement of California harbors and rivers in the northern section while hydraulic mining is carried on.

This is the most important decision ever rendered on the Pacific Coast. The farmers are holding joyous demonstrations in different parts of the State.

THE contract for building the large bridge at Anoka has been awarded to Horace E. Horton of Minneapolis. Price $39,000

PAINTING IRON.

The value of red-lead as a preservative for iron has been generally accepted. Wrought-iron requires a hard and elastic paint, which will hold itself together even if the scale beneath gives way. The following experiments made under the auspices of the Dutch State railroads, may be instructive. Iron plates were prepared for painting as follows: Sixteen plates pickled in acid (hydrochloric), then neutralized with lime (slacked), rinsed in hot water, and while warm rubbed with oil. The same number of plates were cleared of scale, so far as could be removed by brushing and scraping. Four plates from each set were then painted alike—namely, four plates with coal-tar and four plates with iron-oxide A, another set with iron-oxide B, and the remaining set with red-lead. They were then exposed three years, and the results observed were as follows: The coal-tar on the scrubbed plates was quite gone, that put on the pickled plates was inferior to the others. The iron-oxide A on the scrubbed plates was inferior to the other two, while on the pickled plate it held well; the oxide B was found superior to that of A, but inferior to red-lead, while the plates covered with red-lead stood equally well on both prepared plates, and were superior to all others. From these results it is evident that pickling the iron removes all the black oxide, while scrubbing does not. It is also shown that the red-lead unites with oil to form a hard oxy-linseed oil acid soap—a harder soap than that given by any other combination. The red-lead is shown by these experiments not to give way under the scaling; it is more adherent to the surface, more elastic and cohesive. On the Cincinnati Southern Railroad, experience extending over some years has shown that red-lead has proved the most durable paint in the many miles of iron trestle and bridge work. It is found that the iron oxide is washed away by the rain, and perishes in spots, although a valuable paint if frequently renewed. Red-lead, on the other hand, is more expensive than iron oxide, and is difficult to be obtained pure. It is adulterated with brick-dust, colcothar, and other substances, and has lost its high repute. Referring to white-lead as a material for painting iron, one authority observes, that "white-lead should not if possible be used in priming iron, nor in any priming coat; moreover, it is a less desirable overcoat than iron oxide." The class of iron paints compounded of ores of natural iron rust, combined with clay or some other form of silica are very useful, as they contain no water nor sulphuric acid. Magnetic oxide or pure iron oxide is an excellent protection for iron, says one writer: it is impossible to scrape it off. It is also of value in wood-work, and resists the action of salt water and sulphuric gases so destructive to most paints. There is no doubt the great protecting element in paint is the oil, and the conditions required for success are stated to be to prevent the drying part of the oil from becoming hard and dry; the soft-keeping, non-drying acids must be kept from flying away in such a quantity as to reduce the oil to a brittle mass. In other words, the elastic qualities of the oil must be protected from the action of the oxygen.—*Building News.*

What It Will Cost to Construct a Syphon Under Milwaukee River.

This forenoon the board of public works opened bids for the construction of the section of the special sewerage system under Milwaukee River at the foot of Park Street. The bidders were allowed to figure on two plans, one for an iron syphon pipe about 515 feet long and fifty inches in diameter, with two shafts and one connecting sewer. The other plan was for a brick sewer about 540 feet long, with two shafts and a connecting sewer. Three bids were received, one for the brick sewer and the others for the syphon connection. For the latter the figures were as follows: C. H. Starke, $35,000; Clarence S. Brown, $37,750. The only bid for the brick sewer was put in by the latter, the figures being $42,000. Mr. Brown was bidding in the interest of Capt. Casgrain. The board was disappointed at the small number of bids received, as it was expected that proposals would be received from all over the country, on account of the importance of the work. The matter of awarding the contract will be considered at a meeting of the board to be held this afternoon. All the bids are considered a little high, but it is thought that the contract will be awarded to the lowest bidder on the syphon plan. About $100,000 is in hand for the extension of the sewer this year.—*Evening Wisconsin.*

The bidders were all Milwaukee parties and the contract was awarded to C. H. Starke.

Raising and Moving Buildings in America.

In the rapidly growing cities of America, circumstances often necessitate the moving of buildings from their original foundations, either by lifting them vertically to a new level or by transporting them horizontally to a new site.

It is first of all necessary to establish a cribbing of great solidity, resting upon the soil, and presenting an unalterable horizontal plane upon which the screws react used in raising the building. The importance of this preliminary work can be understood when we consider that the least oscillation would crack the walls or ruin the structure.

The principal tool employed for the raising vertically and the transportation horizontally of a building is a cast iron screw (Fig. 1.) with a spherical head. This screw, which is about 20¾ in. long and 3 in. in diameter, works in a cast iron nut which has a collar on its upper end and two flanges upon the sides. When in use a cast iron cap with a sunken centre is placed between the spherical head of the screw and the beam supporting the structure; this protects the wood and facilitates the turning of the screw. Each nut is seated in a block of oak wood, about 3 ft. long, 10 in. wide and 4 in. thick. (Fig. 1.)

The cribbing which supports the edifice is constructed with pine joists about 6 in. square. The joists or blocks at right angles to the wall are about 3 ft. long, the longitudinal joists vary in length according to circumstances, but should always be long enough to carry three or four of the transverse blocks. These must be built up with the greatest care for the reasons given before.

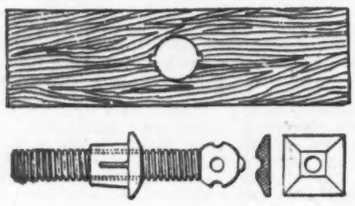


Fig. 1.

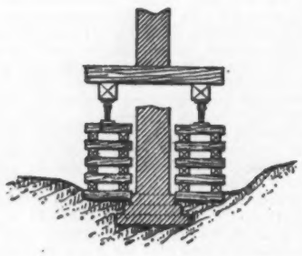


Fig. 2.

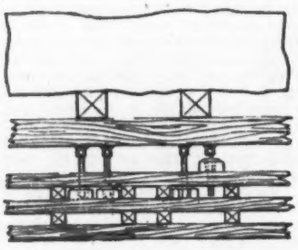


Fig. 3.

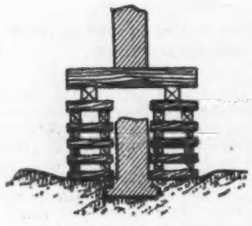


Fig. 6.

The lower story was divided into five parts by four walls in brick masonry 8 in. thick. These walls supported the joists of the different floors. The side walls were 16 in. thick and the front was made up of stone columns and cast iron work. The site occupied by the house was required for railway purposes. This required that the house be raised about 5 ft. and moved back 33 ft. 5 in. During this operation, which lasted 40 days, the occupants of the various offices in the building were undisturbed. When the house was once upon the

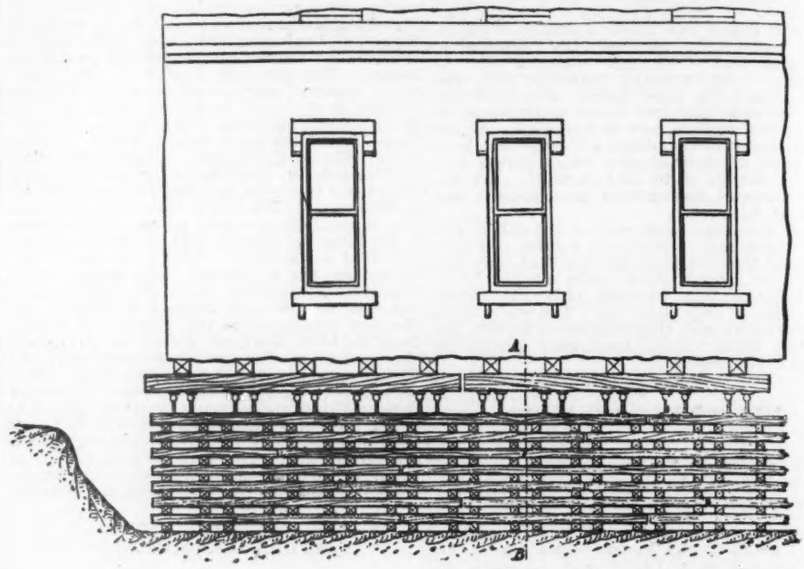


Fig. 4.

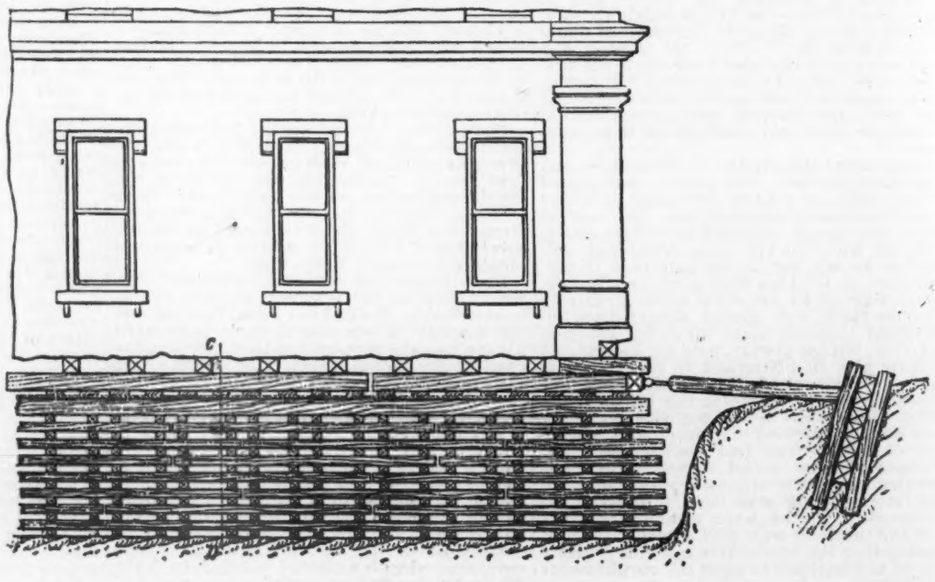


Fig. 5.

RAISING AND MOVING BUILDINGS, ETC.

Another form of screw used in this work is one mounted at the end of a strut as shown on Fig. 5. The timber in this case is hollow at the end to permit the entrance of the screw; the screw, nut and iron cap used are the same as those previously described.

If we add to the above described tools, heavy beams and sliding ways, blocks, etc., we have all the material required in moving a building.

As an example of the application of this method we describe the displacement of a house in Buffalo.

The front of this house measured 78½ ft., its depth was 78½ ft., it was four stories high, built of brick with stone trimmings.

screws, 50 laboring men were employed in moving it, at a rate of 11¼ ft. per day; this is considered slow work, as nearly 20 ft. has been made in the same time. The beams upon which the house slid were greased with tallow and soap.

In the case cited 34 days were occupied in building up the cribbing and preparing for the moving, 500 screws were used in lifting, and 12 screws in moving it horizontally. Holes were first cut in the walls and through these were passed beams of pine 12 in. square and 8 ft. long, projecting equally on both sides of the wall; these beams were about 4 ft. apart between centres. At the same time a ditch was

dug on both sides of the wall to give a firm foundation for the screws. The figures illustrate how this was done.

Each screw was manipulated by one man. At a signal given by a whistle the man made a half revolution of the screw, and continued this until the desired height was attained. The movement is very gentle, imperceptible to the looker-on.

At the first turn given to the screws the walls are torn from their foundation. This operation is carefully watched, and at the least sign of resistance, the rupture of the masonry is hastened by blows with a chisel. When all the screws have reached a height of about one foot, two screws are placed under each beam, making up the height by a cribbing of two tiers on which the second screw is placed. This operation is repeated in the order named until the total height desired is reached. Fig. 3. shows the method of changing the screws.

Fig. 4 represents the building as raised to the required height above the ground and still supported upon the screws. It now remains to remove the screws and replace them by the timbers necessary for the horizontal movement.

These timbers are pine, 8x10 inches, placed on top of the cribbing in accordance with the direction in which the movement is to take place. The surface of these sticks is carefully planed and then well smeared with tallow and soap. On top of these are placed oak planks, one inch thick, which are also greased; finally between the planks and the beams which directly support the walls, blocks of oak are placed, 3x10 inches in cross-section. All is now ready for the end beam (Fig. 5). The sliding ways are prolonged to the new site of the building, supported upon strong frame work firmly founded. When all is prepared, the screws are slackened until the building rests upon the sliding timbers. The propelling screws are then brought into play, the upper end acting against a beam set against the ends of the longitudinal beams (Fig. 5), and the lower end reacting against a solid foundation as shown in the same figure.

In the case mentioned, the speed of movement was 15 in. per hour. When the house has arrived at its destination, the screws are replaced so that the walls can be lowered down upon their new foundations.—(Read before the Society of Engineers, England.)

Railway Construction in British Columbia.

The British *Colonist*, of Victoria, B. C., in its New Year's number, reviews the progress made in the C. P. R. construction in British Columbia. It says: "The contract held by Mr. Onderdonk and those associated with him for construction on the Canadian Pacific Railway extends from Port Moody to Savona's Ferry on Lake Kamloops, a distance of 213 miles. The work in the canyons of Fraser is classed as extra heavy. Mr. Onderdonk began work in the spring of 1880 on the Yale-Savona division. He has pushed the construction of this through with unexampled rapidity. Few have any conception of the almost insurmountable difficulties he had to contend with. Much of the work done in these canyons aggregated $200,000 to the mile. There are no less than thirteen tunnels in almost as many miles, there being no less than six of these in a section of seven thousand feet. For close upon twenty-five miles the line is cut out of solid granite rock.

The steel for the great cantilever bridge that will span the Fraser at Cisco Flat is now lying at Port Moody, awaiting transportation per rail to that point. In a few weeks it is expected that trains will run between Port Moody and Lytton, a distance of 143 miles. During the summer season the number of men employed by the company was about 7,500, of whom 4,000 were Chinese and the balance whites. The average monthly pay roll in the busy season was over $200,000. In addition to the above we learn that the amount disbursed by the Dominion Government on account of surveys, etc., in connection with this work, will foot up considerably over $10,000 a month. Mr. Onderdonk expects to have his contracts fully completed by the fall of 1885. The total of Mr. Onderdonk's contract will be considerably over ten million dollars.

SOUTH AMERICAN NEWS.

FROM THE BUENOS AYRES HERALD.

BUENOS AYRES, November 24, 1883.

THE WESTERN RAILWAY, has bought 500 tons of coal per month during 1883 at $9.50 per ton, also a cargo to arrive $10.50.

The complaints against the Western Railway, for lack of sufficient rolling stock, are well founded. The excuses brought forward are no excuses at all. It might as well have been known two years ago as now what would be required by La Plata and what would be needed by the republic, but no attention has been given to it, until now comes a serious and well nigh ruinous inefficiency which is wholly inexcusable.

OPENING OF RAILWAY LINES.—The Directors of the Western Railway have determined to give the public the opportunity of attending the opening of the branch line to 9 de Julio, tomorrow, Nov, 25th, and a special train will be despatched from the Once Station for that purpose; the price of a return ticket, taken at any station between the Once and Gorostiaga inclusive, being fixed at $50 (Mex.) and at Chivilooy, and beyond $25 (Mex). The special train will return the same day.

NOVEMBER 30.

WESTERN RAILWAY.—The Municipal Council has granted the permission asked for by the directors of this railway, to construct a branch line for connecting the Once Station with the Passe leo Julio. All that is necessary is to construct a line between the Central Station and the Catalinas mole.

No new buildings will be required at the Station. The work, which will be carried out under the instruction of the office of Public Works, will, it is said, be completed in about a fortnight. Considering the great convenience which it will be to the public in general, and to merchants in particular, it is surprising that such a trifling work was not effected long ago.

THE SANTIAGO BRANCH railroad wants $100,000 to spend in December.

THE SOUTHERN RAILWAY company are negotiating with the Provincial Government for a line from the Atlantic coast to their main line somewhere near Ayacucho. The matter has not been concluded, but something of the kind will be done, as has been foreshadowed. There are other railway projects of some importance which are yet to be brought forward.

DECEMBER 6.

HYDROGRAPHIC SURVEY OF PATAGONIA.—The National Government has issued a decree appointing D. Ramon Lista chief official of the Ministry of Marine, assisted by the engineer, Juan Hatterfield, the Lieutenant of the Navy, Miguel Lascano, and the pilot, Edmunda Moysés, to make a careful survey of the sea coast, and of the rivers and lakes comprised in the territory of Patagonia between the Atlantic Ocean, the Cordillera of the Andes, the River Deseado, and the 50th parallel of latitude, and to present to the Ministry of Marine a detailed report of the scientific results obtained, together with a geographical plan of the region explored.

NIVELACION.—The engineers, Laralle and Media, will present, during the month, their report on the survey which they have made of about one-half the Province, comprising 5,300 square leagues. They will also present a scheme for draining that area by a system of navigable canals, opened in various directions.

The course of the rivers Samboronbon and Salado will be rectified in various parts. Other canals will be opened in the zones of Tuja, Ajo, Mansalvo, and Mar Chiquita, which will serve as drains for that region, and will be navigable during portions of the year. The navigable canals will be connected with the drainage canals, so that the waters may be properly distributed in rainy seasons, and may at other periods, be drawn from the Sanboronbon and Salado and other parties to the navigable canals.

The works of navigable canalization which the engineers recommend as being of immediate urgency are those above mentioned, the cost of which is estimated at 25 to 30 millions of fuertes. The principal source from which this money would be obtained would be from the land of a limited width, on both sides the canals which would be appropriated by the Government and resold for agricultural purposes.

The two navigable canals would discharge themselves into the sea, one on each side of the Boca del Salado, and ports would be constructed there capable of receiving the largest vessels employd in the navigation.

DECEMBER 7.

LIGHTING.—D. Angel Estrada has offered to sell to the Provincial Government an electric machine for lighting the new capitol.

RIO IV, Dec. 7.

To-day the trains arrive at 40 kilometres distance from the first station La Paz, and they will probably arrive at Santa Rosa during the month. The embankment between Mendoza and San Juan is concluded for 102 kilometres and the works already reach La Rinconada, at 5 leagues from the city of San Juan.

MONTEVIDEO, Dec. 7.

THE CENTRAL RAILWAY Company has made fresh proposals for the purchase of the Eastern Uraguay Railway,

CORDOVA, Dec. 5.

THE NORTHERN RAILWAY produced in the last two years 90 per cent more than in 1881.

DECEMBER 8.

ENGINEERS.—Sr. Lucas Ruiswick has been appointed mechanical engineer for the works of prolongation of the Northern Railway, in place of D. Antonio Pelaez, who resigned.

Sres. Hermann Dubourgan, Carlos Wickham have been appointed engineers of the 2d class in the Department of Civil Engineers.

NEW RAILWAYS.—On Monday next, a conference will take place between Sr. Mauricio Mayer, a director of the Western Railway, and a committee, consisting of Sres. Rufino Varela, Vicinte Casares, Doctor Alfred Lahite and Dr. Pable Marengo, appointed by the residents in the partidos of Monte and Carmelas, to petition the Governor of the Province for the construction of a branch railway to the points. Funds have been collected to assist the Government, and a guarantee of three per cent. is offered.

THE LARGE CONCESSION of land for colonial purposes made by the National Government to Mr. Langworthy has met here with the usual growl when foreigners bring their money to the country and have the idea of profiting by the investment. The new concession made by the Provincial Government of Buenos Ayres to the Great Southern Railway Company., for a line from Mar de la Plata, passing by Tandil and on the Tres Arroyes, has been another triumph for that enterprising company.

CANALS.—The Province of Buenos Ayres is mostly a plain, traversed by sluggish streams which could be made to supply an entire system of navigable canals throughout the Province. It appears singular that so little attention has been given to this ancient but very useful method of transportation, especially in the peculiar circumstances in which we are placed. Holland itself is not more adapted to canals than Buenos Ayres. The motive power is horses, and nothing so cheap, which could furnish power as horses. Coal we have none, or none has been discovered, and coal imported is very dear, and a formidable element of expense in railway transportation. We have no passible wagon roads, and we see no way to make them, because we have no material with which to do it. To dig canals is easy. There are few cuttings, and almost everywhere the easiest of digging. More than this, these very canals would afford much needed drainage for great tracts of land now suffering from periodical innundations. The cheapness with which produce and freight could be moved by canals would seem to be a conclusive argument in favor of attempting them. The Government could well afford to invite a company to undertake one as an experiment, and as a commercial undertaking, with a fair guarantee for the purpose of solving the question and making an experiment. The Salado, the Sambornbon, or the Tapalquen would do well as a beginning, without waiting for a long and minute survey of all the Province.

Westinghouse Air Brake Patents in Court.

PITTSBURG, Penn'a., Feb. 4.—This afternoon, in the United States Circuit Court, William Loughridge, a resident of Baltimore County, Md., filed a bill in equity against the Westinghouse Air-brake Company to restrain them from further infringement on patents of which he claims to be the inventor and patentee, and which constitute the whole stock in trade of the company named, as they embrace all the patents used in manufacturing the air brakes which have made the firm wealthy and famous. The statement of the complainant is that he invented the improved mode of operating car brakes now used by the Westinghouse Company before the 12th of April, 1864. The other inventions to which he lays claims are as follows: An improved method of applying steam to car brakes, patented April 19, 1864; an improvement in steam and air brakes, patented Feb. 11, 1873; improved pneumatic air brake for railroad cars, issued to Chas. R. Peddle, and an improvement in the pipe coupling, issued to Thomas Smith, both of which last inventions the complainant alleges were assigned to him. The suit involves millions of dollars.

The Brandt Rock Drill as used on the St. Gothard Railway.*

The Pfaffensprung tunnel of the St. Gothard Railway which is 1460 m. in length (1600 yards), is remarkable as having been driven chiefly by the Brandt drill, which is a rotary drill worked by hydraulic power. This drill has since been employed with great success at the eastern end of the Arlberg Tunnel.

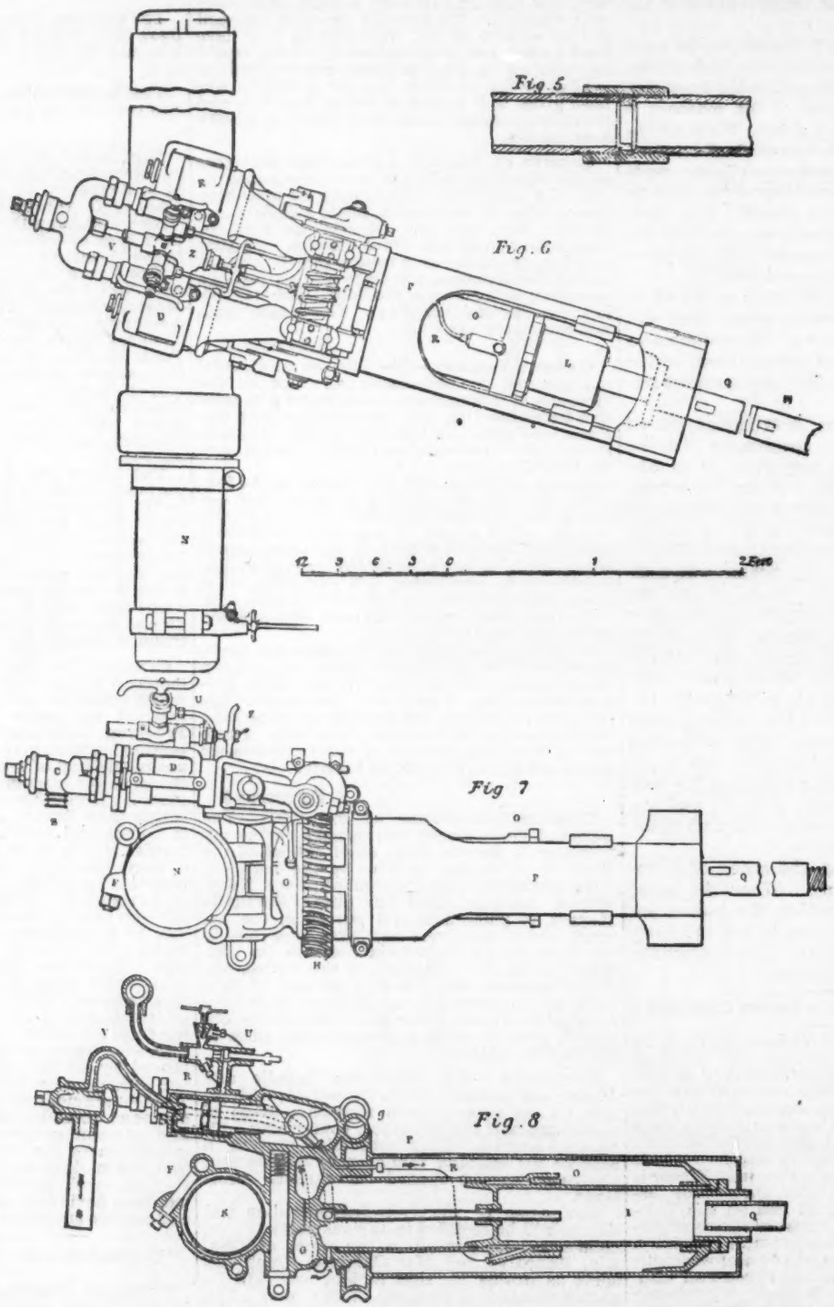
The apparatus required for the Brandt drill consists of two high-pressure pumps with differential pistons, driven by a turbine; of an accumulator; and of a regulating valve, intended to regulate the pressure and prevent shocks, both within the drill itself and in the pipe leading to it. This pipe is of wrought-iron 38 mm. in diameter (1½ in.) The joints are made by screwed sleeves, Fig. 5, which pass over the ends of the pipes. A copper ring is fitted between the ends, each of which is brought to a sharp edge entering a groove in the copper. The ends being screwed left and right-hand respectively, the tendency of the sleeve is to draw the two ends together, thus causing them to bite into the copper and make a firm joint. The pressure is 80 to 100 atmospheres, or from 1200 lb. to 1500 lb. per square inch.

The machine itself is shown in Figs. 6 to 8 in elevation, longitudinal section and plan.

A socket piece G, which is movable about a piece connected to a horizontal shaft N, carries the boring cylinder O. Within the cylinder is a hollow plunger I, which is pushed forwards by the pressure, and forces against the rock a steel drill M, Fig. 6, keyed to the piston rod O. The total pressure on the drill is from 10,000 kilos. to 12,000 kilos. (22,000 lb. to 26,000 lb.) To the socket G are attached two small hydraulic motors D and E, of about 13 horse-power each; these actuate by cranks a shaft carrying a worm. This worm gears with a worm-wheel H, turning loose upon the cylinder O. The wheel H is solid with the outside cylindrical casing P, Fig. 7, on which slide the piston-rod guides; the rotation of the casing by the wheel H accordingly turns the piston and piston-rod, and therefore the drill itself, at a speed of seven to ten revolutions per minute.

The shank of the drill is of steel and hollow, having a diameter of about 64 mm. (2½ in.) whilst the cutting edge or crown is widened out to about 2¾ in. in diameter. This edge has four teeth like a saw carefully hardened; the teeth are re-sharpened as they wear down. The shank is made in pieces of a fixed length, which can be easily screwed one on to the other as required.

The working of the machine is carried on by means of the valve chest B, which contains a single stop cock Z admitting the pressure water simultaneously into the branch pipe leading to each of the motors D and E; and a two-way cock for producing the forward or backward movement of the drill plunger I. By opening this cock the pressure of water is admitted through the pipe U to the rear of the plunger, where it acts upon the full area of the plunger to press the drill forwards against the rock; and on closing the cock the drill is drawn back by the water pressure acting constantly upon the small annular area in front of the plunger piston through the pipe R. By partly



THE BRANDT ROCK DRILL.

* Extract from Paper read before the Institution of Mechanical Engineers at the Liége meeting, 1883.

closing the two-way cock, the pressure on the rear of the plunger and therefore upon the drill, can be moderated.

The attention required is so small that one man easily manage two or more machines.

The hole can be washed to clear it of debris, by closing the cock C in the pipe leading from the motors to the escape hose S. The exhaust water from the engines instead of escaping at once, is then led through the copper pipe D, into a pipe running along the centre of cylinder O, and opening into the inside of the plunger I. From thence it passes along the hollow piston rod and drill, and escapes at the face.

The supporting shaft N consists of a tube with a plunger fitted into it. By admitting the pressure-water to the interior, the plunger head is forced out against the side of the heading, and the shaft is thus set fast. The plunger can be withdrawn by means of a two-way cock, in the same way as that of the working cylinder. The shaft and drills are carried on a small wheeled truck, and are counterbalanced so as to be in equilibrium when the shaft is not fixed. The shaft can be swung round parallel to the line of the heading, so as to occupy less room when advancing or retiring.

The mode of operation with the machine is as follows:

The truck having been brought up to the face of the heading, a distributing piece with connecting lengths between is screwed on the end of the main-pressure pipe. A copper pipe transmits the water-pressure from the main to the shaft N. This shaft is swung round across the heading at a distance from 5 ft. to 6 ft. behind the face, and a turn of the cock is sufficient to fix it to the sides. The drills are then connected by other pipes to the distributing piece, and directed to the proper points of the face. The stop-cocks are then opened and the boring commences. The total feed of the drill is 9.84 in. When its full range has been reached, the two-way cock is closed so as to withdraw the drill, and another length is screwed on to the shank. The operation is thus continued until the hole has reached a depth of from 40 in. to 48 in. The depth to which a drill will bore before it requires sharpening depends of course upon the hardness of the rock. In the granite and quartzite of the Pfaffensprung tunnel, this depth varies from 8 in. to 20 in., but in limestone or dolomite it has reached 10 m. (32.8 ft.) The number of holes pierced at one time varies from four to six. As soon as they are finished, the drills are withdrawn while the charging commences. When the shots have been fired, water from the pressure main is projected through a pipe with a rose on the end against the face of the working, and serves both to absorb the fumes of the dynamite and to cool the air.

Dynamite as a Well-Driver.

The charge of dynamite in the well at Henry D. Duppe's Chemical Works, Walpole, Mass., was successfully exploded at 9.45 o'clock Friday morning Feb. 1st. The well was 1,000 feet deep and furnished a supply of fifteen gallons of water per minute. This quantity was found to be inadequate, and measures were adopted to open the fissures of the rock still further by the use of explosives. Three cans of dynamite, containing in all 208 pounds, were connected with a battery and lowered to the bottom, but through some defect in the connections they failed to explode. Several ineffectual attempts were made before success was gained. Another trial the same morning gave the desired results. A dull, rumbling sound was heard, and immediately a column of water eight inches in diameter was forced through the mouth of the tube to a height of over two hundred feet. In its descent the earth was somewhat washed away, but this was the only inconvenience felt from the explosion. Some trouble was anticipated, but the shock was scarcely felt in the town.—*Boston Journal.*

Effect of Climate on Railroad Ties.

At a recent meeting of the Institute of Civil Engineers for Ireland, a paper was read on "Railroad Ties in Mexico," from which we extract the following: "The sleepers used are nine feet long, ten inches wide, and five inches thick. The selection of suitable wood for sleepers has occupied much attention. Good, well creosoted Baltic sleepers have been tried on a large scale, and found to become decayed and useless at the end of about four years. Hard, strong oak sleepers, obtained in the country, have also been tried in large quantities, and found not to last more than three or four years. The timber of both the Baltic and oak sleepers seemed to undergo a rapid change and become quickly converted into a dry spongy consistency.

There was no appearance of insect ravages; the timber had evidently not been able to withstand the great heat or dryness of the atmosphere. The best wood yet discovered for sleepers is zapote. It is essentially a tropical timber, and is exceedingly durable for outdoor or indoor work above or below ground. Samples of this wood taken out of buildings said to have been erected more than two centuries ago did not show the slightest signs of decay; the wood was as sound as the day it was put into the building. This wood, however, is very scarce and very expensive. In color it is nearly as dark as logwood. It is very heavy and sinks in water, and is so hard that the boring of the holes for the spikes and forming the grooves for the rails is very laborious work. It appears to be almost impervious to decay, but it has a tendency to split if exposed to the heat of a tropical sun for a few months. For this reason the zapote sleepers must be kept equally covered with ballast.

The next best quality of timber yet found in the country, and of which by far the greater number of the sleepers on the line are made, is sabino, a species of cedar. The general color of the wood is either a light yellowish brown or a light pink, and in appearance is very similar to the cedar used for ordinary lead pencils. It is a resinous wood, with a peculiarly fragrant odor, and is straight grained, readily worked, and does not appear to be attacked by any insects. In many of the very old buildings on the upper plains, beams and posts of this timber are still standing, and shows very little signs of decay. For sleepers it is very durable, and those that have been down for several years indicate that they are more likely to give way from the actual wearing or cutting in of the rail flange than from natural decay."

A Singular Phenomenon in Sand.

NEW ORLEANS, Feb. 3—A remarkable physical phenomenon has been observed by Capt. W. L. Marshall, of the United States Engineers, stationed at Vicksburg and in charge of the river improvement work at Lake Providence, La., for the Mississippi River Commission. Capt. Marshall, in a report just made to B. M. Harrod, of the commission in this city, communicated his discovery. The statement is as follows: A few piles have washed out of the five-row dike at Mercersville chute. There was a thick foot mat and a cubic yard of stone per running foot of dike. A remarkable phenomenon is shown here: A pile five feet longer than the rest marked to indicate the front of the dike at high water still remains standing upright and firm two feet below the lower row. The drift is arched across the opening and there is no pressure upon this pile. It has traveled sixty-two feet down stream erect and firmly imbedded in the sand. Such cases have been reported heretofore but not credited by me. This case I observed myself. It can only be accounted for on the supposition of a bodily movement of the sand foundation. In other words, it would seem as if the material in the trough or bed of the river were in motion. In no other way as it appears can this pile maintaining its solid hold in the mud and sand and its perpendicular position be accounted for.

A STOP-COCK having an outlet for draining the valve when closed is of the following description: A conical valve is inserted within the water-pipe at right angles thereto. To the valve is attached a spring handle which, when revolved, lifts the valve and opens the discharge. A small drainage-pipe is placed below and parallel to the water-pipe. To the valve is attached an elastic disk which is held in a curved position opposite the mouth of the drain-pipe. When the valve is closed waste-water passes out of this pipe. As soon, however, as the valve is raised, the elastic disk straightens out and closes the mouth of the waste-pipe, thus preventing water from the main water-pipe to pass out of the drain. This stop-cock has been patented by H. Taylor, R. B. Sharp and T. J. Cain all of Cleveland, Ohio.

SELECTED MISCELLANY.

IN the House Committee on Railway and Canals on the 6th, Representative Murphy was instructed to report favorably his bill for the construction of the Hennepin Canal, between Hennepin, Ill., and the Mississippi River, a distance of 75 miles. The bill provides for an appropriation of $1,000,000.

THE Rubicon is the ancient name of a small stream thought to be the modern Pisatello, which formed the boundary between Italy and Cisalpine Gaul. It is celebrated from Cæsar's having hesitated about crossing it with his army, and initiating civil war, in the year 49 B. C. Hence "to pass the Rubicon" has become a proverbial phrase to denote the taking the first step in an undertaking from which one cannot or will not recede.

IN accordance with the act passed at the last session of the Pennsylvania Legislature authorizing the appointment of a commission to revise the mining and ventilating laws of the anthracite region, Governor Pattison has appointed the following: H. Swoyer and James Fisher, of Luzerne County; Thomas H. Phillips and James Brennan, of Schuylkill County; Alexander Fulton and Thomas Roney, of Northumberland County; Lewis A. Riley and David Walsh, Columbia County; Samuel Hines and James White, of Lackawanna County; and W. T. Kemerer and Philip Coyle, of Mauch Chunck, Carbon County. In this list there are six coal operators and six miners.

AN examination of the records in the Secretary of State's office, Albany, N. Y., showing that within the last three years the number of companies incorporated under the telegraph companies act is 13.5 distinct organizations, with a capital aggregating $125,000,000. This includes numerous telephone companies, some of a local character, and also schemes for the promotion of every phase of electrical contrivances for the transmission of intelligence. In no other single line of activity do the records of the Secretary of State show anything like the competition illustrated by these figures. This condition of things will be of interest in view of the discussion at Washington as to whether the Government shall go into the telegraph business.

IT was the custom of the wealthy man of olden time in the Chinese empire to procure his coffin when he reaches the age of 40. He would then have it painted three times a year with a composition resembling silicate paint or enamel, which formed an exceedingly hard coating. The process of making this paint is one of the lost arts of China. If the owner lived long enough, the frequent painting—each coat being of considerable thickness—caused it to assume the appearance of a sarcophagus, with a foot or more of this hard, stone-like shell. After death the veins and cavities of the person's stomach were filled with quicksilver, for the purpose of preserving the body. A piece of jade would then be placed in each nostril and in one hand, while a piece of bar silver would be placed in the other hand. The body thus prepared was placed on a layer of quick-silver within the coffin; the latter was sealed, and the whole deposited in the final resting place.

OUR literature of transportation is only in its infancy notwithstanding Professor McMaster's book. Some pious soul many years ago saved his pamphlets, and I recently bought a volume of them in which is a report on the Hudson River Railroad of the date of 1846, before that road was undertaken. Two or three points from it are curious. Says the engineer, John B. Jervis: "Chestnut cross sleepers are the only timber I propose to use in the superstructure, at the rate of seven sleepers to eighteen feet. The price of iron rails delivered in New York is $75 per ton. I propose to use a rail weighing seventy pounds per yard. The average price of farms along the line is not far from $50 an acre." The engineer lays down the entire cost of the railroad from Chambers St., New York, to Greenbush, opposite Albany, at $6,000,000. The programme was laid out for competition with steamboats which charge 50 cents for passage to Albany, 50 cents for a birth, 50 cents for supper, and 12½ cents to take care of baggage, making the cost to Albany $1.62. The chairman of the great meeting to build the Hudson River Railroad was the late Mayor Havemeyer.

In the same book of pamphlets I have referred to above, is a "description of the American Electro Magnetic Telegraph, now in operation (1845) between the cities of Washington and Baltimore, by Alfred Vail." It is strange to see this little pamphlet and think of the Western Union Telegraph Company with its enormous connections. In this advertising pamphlet the telegraphic alphabet and language are given and pictures are put in of all the instruments.

I recently asked the electrician of the Western Union Telegraph, a French gentleman and a graduate of the School of St. Cyr, if there is any company in the world to compare with the Western Union. With a good deal of pride in his own country, my friend said: "No, the Western Union Telegraph Company is not only the greatest corporation in electricity on the globe, but it produces the greatest results. It can put a message in six minutes from the hand of the sender in New York into the hand of his factor in Chicago, and that includes the delivery of the message as well.—*Broadway Lounger.*

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Clemann's RAILROAD ENGINEER'S PRACTICE, Third Edition is now on our shelves. We have already filled all waiting orders—nearly one hundred in number—and will be pleased to fill any others by return mail. The book is what it claims to be—"A Short but Complete Description of the Duties of the Young Engineer in Preliminary and Location Surveys and in Construction." It has been revised and enlarged by its author, and is a compact, well-printed, and finely bound book of 148 pages, which cannot fail to grow in popularity, as its superior merits are known. The table of contents has been fully advertised elsewhere in this journal, and the best that we can say is that the book is well worth its price.

Liverpool Engineering Society.

The first meeting of the Session was held on Wednesday evening January 16, at the Royal Institution. The Vice-President, Mr. J. S. Brodie, M. Inst. M. E. in the chair, a paper entitled "The Application of Compressed Air to Mining," was read by Mr. M. G. Johnson. The author commenced by pointing out how necessary to the mining engineer was the transmission of power, and enumerated the various methods, namely: steam, water, wire-rope, compressed air and electricity, explaining various properties of each as available for under-ground working and pointing out that with compressed air there was a large power available at any part of the mine for working machinery and also for ventilating purposes.

Holyoke, Mass., Reports for 1883.

From the reports, etc., of Holyoke, Mass., we make the following extracts relating to the material growth of that city in 1883:

From the report of the Water Department we find that the total receipts for last year were $62,098; $31,798 was expended on construction, making the total cost of the works to date of Jan. 1, 1884, $368,264. A small reservoir of 70,000,000 gallons capacity has been constructed for storage purposes, at a cost of about $7,985. 20,313 ft. of supply mains were put down in 1883. The length of cast-iron mains is now 26 miles 933 ft., nearly 5 miles of temporary wrought-iron mains are in use. The present services taken now number 1,637, with 201 public hydrants and 350 private hydrants; 117 meters are in use, 29 having been put in within the year at a cost of $1,060; the total receipts from metered water is $11,972 per annum.

The sum of $10,859.80 was expended during the year in the sewer department, exclusive of $14,065, spent upon the Front St. sewer. The Mayor recommends the completion of the Front St. sewer and the building this year of new sewers in the Manchester Grounds, where he says there are from 150 to 200 houses with out sewerage of any kind.

About $24,000 was expended upon the streets, in paving, etc.

THE DISMAL SWAMP OF VIRGINIA.

Richard Lamb, C. E., of Norfolk, Va., has made an interesting report to the managers of the Dismal Swamp Land Co., upon this mysterious and little-known region.

Commencing with a report of a certain Captain Byrd in 1728, and giving at length the surveys and opinions of Washington in 1763, Mr. Lamb comes down to the present time with his own experience, and reports upon the feasability of reclaiming many thousand acres of valuable land by a proper drainage system.

The Dismal Swamp is a great basin about 50 square miles in area; and Lake Drummond, the deepest portion, has a general water surface lying 22 feet above mean high tide. The geology of the Swamp is as follows: First, a stratum of peat or vegetable matter from ten to fifteen feet deep; next, two feet of yellow clay, then four to five feet of blue clay, and finally, a bottom of quicksand. The water in the quicksand formation maintains the level of tide water.

Mr. Lamb divides the area of the Swamp into three sections, by a forked summit contour of a low level, and gives his plans for reclaiming about 14,000 acres of the Company's land, at an estimated cost of $36,000 or about $2.83 per acre.

Contrary to the usually conceived idea of swamp land, the Dismal Swamp is notoriously healthy, and the land that has already been drained is among the most fertile in the State of Virginia. It is unusually well adapted to the cultivation of rice, and with the system of drainage ditches and sluice-gates proposed by Mr. Lamb, would be particularly so.

TAUNTON (MASS.) WATER-WORKS.

The eighth annual report of the Water Commissioners of Taunton, Mass., is an interesting document, and from it we make the following abstracts:

The city now has 20,000 inhabitants, and the average daily water supply is 611,816 gallons. According to the report, a domestic pressure of 55 pounds is obtained with a consumption of one ton of coal per day, on an average. There are now over 47 miles of main pipe, 2289 services and 464 meters; there are 408 hydrants and 264 gates in the system. The total revenue for 1883 was $41,002.10; the total maintenance account for the same period was $36,811.45. The construction account for the same period was $63,367.79, making the total cost of the works to date of November 30, 1883, $485,592.45.

The water supply of Taunton comes from a filter-basin with dry stone and sodded sides lying along the Taunton River, and into this is poured the contents of a subterranean filtering conduit, 900 ft. long; this last is the most productive source of supply.

Last year, the supply failing and becoming bad, a thorough cleaning of the basin and a portion of the conduit became necessary, water being meanwhile taken directly from the river, to meet the daily demand. In referring to the "cucumber taste" complained of, before and after the basin, etc. was cleaned, Dr. Presbrey, of Taunton, reports as follows: he says the heat of the sun upon the shallow water developed an abundant growth of algæ, which gradually collected at the bottom of the basin. During the cleaning operation the open stone work in the slopes, made it impossible to remove all of this growth, and although when the basin was first refilled, the water was pure, the basin was again, within a week, loaded with the same algæ, and with the same objectionable taste. These algæ, upon examination, Dr. Presbrey says, proved to be the ordinary varieties of fresh water life—Nostocs, Diatoms, and Desmids. He hopes that a second cleaning of the basin, and the maintenance of a higher water level will remove the taste complained of. The water is disagreeable but not unhealthful, according to the analysis made, and is better, by the same analysis, than the well water.

KANSAS CITY STREET PAVING.

Chief Engineer Knight and the public improvement Committee of Kansas City, are at odds with the property owners concerned, in the matter of a late awarding of contracts for street paving in that city.

The work to be done was the laying of seven inch white cedar blocks on a nine inch concrete foundation, and in another portion, of stone blocks set on a nine inch bed of hydraulic cement concrete. The total amount of the wood pavement was about 33,700 sq. yards, and of the stone, 7,750 sq. yards.

The cause of complaint is that while James McGonegal, a reliable contractor, bid $2,60 per square yard for the whole of the wood pavement, only one portion was allotted to him, and the other parts given to two other contractors at $2.64 and $2.68 per square yard respectively.

The argument of one party is, that by this action abutting owners must pay the excess; that McGonegal, being admittedly competent by receiving one portion, is unjustly treated by being deprived of the two-thirds of the work; and that a bad precedent is established for future letting by the present action of the engineer and committee.

The citizens interviewed by the *Daily Times* are divided in their opinions, one party arguing as above, the other commending the judgment of the letting parties in dividing the contract; that the work was too much for one man to do properly in the given time—fifty days—and the blocking of streets and public

inconvenience would be less under a divided contract.

The majority seems to be against the award as made and it is supposed by many that the work, excepting the portion McGonegal now has, will be relet. The Councils and the Mayor have not confirmed the award as yet.

At this distance from the scene of action we can make no comments, excepting to say that from the tenor of the press, Mr. Knight has the entire confidence of all parties concerned; and we must suppose that in using his discretion, he acted for the best interest of the citizens, guided by circumstances not given.

PANAMA CANAL NOTES.

The material removed on all the works, in November was 82,000 cu. yds.; the total removed to December 1, 1883, is 527,000 cu. yds.

The second Huerne dredge left the north of Delaware Bay on Nov. 30, at 7:30 A. M., and arrived at Colon on Dec. 10, at 10 A. M.

Mr. Iribe has been appointed general superintendent of the Panama R. R., in the place of Mr. H. A Wood, who has resigned.

The mean temperature for the year 1882 was 78.6° Fahr., at Colon; 79° at Gamboa, and 80½° at Naos. The extreme ranges of the thermometer at the points named for 1882, were as follows:

	LOWEST.		HIGHEST.	
	TEMP.	DATE.	TEMP.	DATE.
Colon.	63.14° F.	Aug. 7	92° F.	Oct. 18
Gamboa.	52.1° F.	Jan. 17	98.6° F.	June 11
Naos.	67° F.	May 8	94.6° F.	May 22

The temperature of the sea-water varies at Colon, from 78.6° F., in January, to 82.6° F., in September. — *Bulletin Canal Interoceanique, Jan.* 15.

Comparative Cost of Bridges on the Arlberg Railway.

The last number of the *Annales des Travaux Publics*, in an article upon the Arlberg tunnel and railway, gives a tabular statement of the estimated cost of bridge construction on that line. The table also makes a comparison of cost, in some cases, between iron trusses, iron arches, and masonry arches. All masonry was rubble instead of the cut ashlar, usually employed on similar work in Europe. The detail of trusses is not given.

Location of Bridge.	Nature of Structure.	Surface cov'd in sq. ft. in plan.	Cost per sq. ft. of cov'd s
Oetz	Iron through, curved top chord, 262 ft. span	19.027	$2.04
Inn	Iron deck, curved top chord, 197 ft. span	24.226	1.58
Trisana, 1	Iron through, curv'd top chord, 377 ft. span	117.067	.99
" 2	Iron arch, 377 ft. span	117.067	1.05
" 3	Masonry arch, 377ft. span	117.067	2.69
Alfenz	Arches in masonry—one 65.6 ft. span; two 39.4 ft. spans	8.922	1.56
Waldli-tobel, 1	Arch in Masonry, 135 ft. span	12.147	1.12
" 2	Iron Girder, 135 ft. span	12.147	1.16
Radona-tobel	"	7.417	1.48
Schmied-tobel 1	Masonry arch, 203.4 ft. span	34.507	1.02
" 2	Iron deck, curved bot. chord, 203.4 ft. span	34.507	1.13

For bridge piers of 50 metres (164 feet) or over in height, the height of the Trisana piers, the Austrian engineers express their preference for rubble stone masonry, as against iron piers. This is for a single track road, and the reason is, less oscillation from wind pressure.

In connection with the above table, it is remarked that each viaduct or bridge is calculated for a load of three eight-wheeled locomotives (European) coupled. And, also, that the price of plate iron in Austria is 33 per cent. higher than in western Europe, where bridges in iron are only 16 per cent. cheaper than masonry construction.

THE CORINTH CANAL.

The work of piercing the Isthmus of Corinth goes on rapidly. At the mouth of the Canal, upon the Egina gulf, a city called Isthmia, has been created, containing about 200 buildings for the workmen, shops, etc. About 1,200 laborers are engaged.

In October last the dredging at the two ends of the Canal was commenced, with a Schimmelbush dredge and two Ball pumps. The dredge, on the Isthmia side, handles 2,000 to 2,130 cubic yards in 24 hours The two Ball pumps are at work on the Kalamaki side and near Corinth.

The railway connecting the shops and yards of the upper level was finished on Sept. 30, 1883. In removing the material from the higher workings, four locomotives of 21 tons each, 180 wagons of four cubic yards capacity each, and 9 miles of track are employed.

The rip-rapping of the permanent dikes on the Corinth side is being vigorously pushed, on Oct. 20 the two dikes had been finished for a length of about 183 feet each.

The necessary plant and all the material necessary is now on hand, with the exception of two more dredges of 300 horse-power each, now under construction at Lyons.—*Annales des Travaux Publics.*

The Sandwich Water Works, Dekalb Co., Ill.

These works have just been completed at a cost of about $13,200. The contracts were let on Sept. 28, 1883. The source of supply is a spring flowing at the rate of 300 to 500 gallons per minute. The pump was made by the H. R. Worthington Co., of New York, it has an 18½ in. steam cylinder, 9½ in. water cylinder and 10 in. stroke. The water is delivered into a stand pipe, 12 ft. in diameter and 100 feet high, with iron in shell ranging from ¼ in. to $\frac{7}{16}$ in. in thickness, built by the Excelsior Iron Works of Chicago.

The engine house is a substantial brick structure 14x28 ft. with a well alongside from which the supply is taken, 14 ft. in diameter and 29½ ft. deep. As soon as required by an increased demand, this well will be sunk into a deeper gravel stratum, greatly increasing the supply. One vertical 54 horse-power boiler supplies the steam.

The water mains are of Kalmene, they range from 8 to 4 inches in diameter, over one mile is now laid. The supply pipes are wrought iron from the National Tube Work, McKeesport, Pa. Twelve Ludlow hydrants are now in position.

OUR INDEX.

Though late it is out at last, and we are no less pleased with the event than are those of our subscribers who have favored us with a daily growl at its non-appearance.

The tabulation and proper classification of some five thousand articles and items of news is in itself no light task; but circumstances over which we had no control delayed the matter still further.

In some respects the preparation of this index was a revelation to ourselves, for it brought us face to face with the mass of material an engineering newspaper, like our own, has to deal with in the space of one short year.

To attempt to enumerate the various items is to repeat, in a measure, the labor of the past weeks; a task for which we have no inclination at present. But we believe that no occurrence of any importance in the world's engineering history of the year past has been omitted in our columns. In many cases such occurrences have been simply mentioned, where want of space and general interest forbade their treatment in full; in other cases, columns of matter have been laboriously boiled down into paragraphs, so that the pith and marrow, alone should be presented to our readers.

On the subject of railroads, the index is evidence of the field covered; and while we have dealt rather with the constructive department than the organization, yet, in the interest of engineers wanting employment and contractors seeking work, we have attempted to note each project as it presented itself, together with the progress made upon those under contract. Nearly six hundred railroads, old and new, at home and in foreign lands, have been mentioned in some connection during 1883.

American water-supply, rapidly developing into one of the most important branches of the engineering profession, has received especial attention; and we might remark that this subject is now an established and recognized feature of our journal, which is bringing with it a substantial reward for the labor expended upon it.

Sewerage, canal-making, river improvement, contracting and building news, all occupy much space in our list; and to this list we must refer our readers; space will not permit our posting them into the ledger of the year.

In the column of personals, the movements of and items of news concerning nearly five hundred engineers and those associated with them have been recorded.

The meetings of the various engineering societies have been given at length, together with abstracts of their proceedings.

Forty-six tunnels, projected and under way, have been mentioned or described. The St. Gothard and its later rival, the Arlberg, have been very fully treated upon and illustrated. And the Panama Canal, the most colossal engineering work now in progress, has been mapped, cross-sectioned and described by us to a much greater extent than by any other American journal. Two great American engineering works, each in its class, among the boldest in conception and most successful in execution, were finished in 1883; we refer to the East River Bridge and the Improved Sewerage System of Boston. Neither of these important works of construction are anywhere more fully described and illustrated than in the last volume and those proceeding it, of ENGINEERING NEWS. To-day the technical press alone preserves the detailed history of these works, a statement which implies, on the part of the civil authorities in charge, either a lack of appreciation of the value to engineers of a full and authoritative connected description from the hands of the engineering staff of these works, or a lack of public spirit in appropriating the amount required for its publication.

The official reports of the government, cities and boards of public works contain much information of general value to engineers; this matter we have attempted to give our readers, during the year by sifting it out from the dry pages of merely local and official value. We hope they have been appreciated in proportion to the labor involved.

In the matter of Contracting Plant, we have not done quite as much as we originally expected, for the material is most difficulty of access. This is a field we are especially desirous of extending, for we are convinced, from the nature of the communications reaching us, that our subscribers generally regard those we have presented as among the contributions of greatest practical value to the engineer. But we require for the extension of this scheme, the assistance of the working engineer who moves daily among the appliances wanted; they cannot be dug out in the office because they are not on record. We again ask that sketches of any tried article of plant, of practical value, be sent us. No matter how crude the sketch, so that it is accompanied by dimensions and sufficient detail; we will put it into shape; no matter how simple the contrivance, it is all the more likely to be of practical and general value.

THE WATER SUPPLY OF KALAMAZOO.

Mr. W. R. Coats, C. E., in a paper read before the State Association of Civil Engineers and Surveyors, at East Saginaw, Mich., on January 2d, 1884, speaks as follows of the water supply of Kalamazoo:

In 1871, a public water supply becoming necessary, he decided, after considerable study of the subject, that a well sunk deeply into a water-bearing stratum at that place, would yield the most potable water. He was lead to this conclusion by the fact, now established that while the upper levels of all subterranean water strata are contaminated by the surface drainage, a point exists at no great depth usually, where the water can be obtained filtered of all dangerous matter, this last being held in suspension in the superior layers.

Analysis of the water in many private wells in Kalamazoo showed that they were dangerously contaminated; test tubes were then sunk in this stratum, and examination proved that while the upper layers were bad, as in the wells, a comparatively few feet below, lay good and pure water.

In the plan adopted, a circular caisson with impervious sides, was sunk to the depth of 26 feet into the water-bearing stratum. This caisson was built of brick laid in hydraulic cement, and was 24 feet in diameter. An excavation down to the water stratum was first made, 30 feet in diameter and sheeted with wood; at this point an iron shoe, cast in eight segments, was laid. Secured to this shoe was a complete skeleton frame-work of iron extending to a height of 26 feet and forming a thorough vertical and horizontal bond. The brick wall was 26 inches thick at the base and 18 inches thick at the top, with batter on the outside to decrease friction; and when finished it was coated with two coats of cement mortar inside and out. The caisson was built up complete before sinking. The caisson was sunk without difficulty, by dredging without removing the water.

Upon completion a test pumpage of four million gallons per day, only reduced the level of the water about one-third its depth below the top of the water-bearing stratum.

Mr. Coats believes that in many communities this is the proper solution of the question of a pure domestic water supply, as it does away with expensive reservoirs, long lines of force main, etc. Kalamazoo, of course, depends upon its pumps, which in this case maintain an average pressure of 45 lbs. at the works, with the reserve ability of raising that pressure to 90 lbs., when circumstances demand it. He believes that much local waste is prevented by the low pressure on the mains generally maintained. A tank-reservoir of steel or iron in addition, with a capacity of one full day's consumption, will do away with the necessity for pumping at night.

THE TOPOGRAPHER.

To save our own time and that of our correspondents, we give a general sketch of the contents and character of Prof Haupt's new book. We do this in answer to the numerous inquiries concerning the work which come to our office, notwithstanding the fact that we have already given a full table of contents in our advertising columns.

The first chapter is devoted to the requirements for reading the face of nature, and the cultivation of judgment on the part of the observer; enabling him, after sufficient patient practice, to dispense in a great measure with any other instruments than those nature gave him. The more attention paid to this preliminary training and the more expert he becomes, the better the topographer. The study of natural waterways, the analysis of slopes and their definitions, form an essential part of this chapter.

Chapter Two treats of the instrumental outfit, such as the prismatic compass, barometer, odometer, pedometer, clinometer, sextant, etc.; Airy's Tables for reading barometic measurements are given to heights of 12,000 ft. and with them forms for noting measurements and methods of correcting for atmospheric variations. The different instruments are illustrated and their use described.

Chapter Three is upon the scales of maps, telling how to select and use different scales. Tables are given showing map equivalents for each lineal inch of a map in one hundred cases and the authorities; these tables give the equivalent in miles, kilometers, chains, poles, metres, yards and feet of each inch of map, and also the number of acres per square inch. The last column, we might remark in passing, is an extremely useful one in estimating areas of water shed, etc., when, as is sometimes the case, a variety of maps have to be consulted. A reciprocal table follows this, showing the number of inches and parts thereof, of the various scales given, which represent one mile, one kilometer, one chain, etc.

Chapter Four gives the methods of taking and recording notes, with the different instruments described; examples are given from actual surveys, and pages of the note books are shown.

Chapter Five is devoted to the conventional signs appropriate to the class of work in hand; treating of vertical and horizontal *hachure*, and the contour systems, and also colored topography.

Chapter Six is on reconnaisance, with the requirements for improvements of rivers, railroads, canals or highways; and in each case suggestions are made to the observer of the essentials to be noted. This chapter is illustrated by a map and the full notes of a reconnaisance made by Col. J. C. Fremont in Oregon in 1842. The method of proceeding and the meaning of primary, secondary and tertiary triangulation, is explained, station-marks described, etc.

Chapters Seven and Eight—the latter without a chapter heading—describe the manner of "filling-in" a triangulation and the instruments necessary. The Stadia system, with its rods, reduction tables and various instruments used, is given at length. The plane-table is illustrated and explained, with suggestions for its use. The transit is next taken up, with its use in determining the true meridian, observations on a circumpolar star, azimuth of the Pole Star, determination of latitude, etc. The use of the Solar Transit is described.

Chapter Nine is devoted to the theory and practice of Leveling, and contains a useful summary of the sources of error, as given by Lewis D. A. Jackson, in his "Aid to Survey-Practice," London, 1880.

In Chapter Ten the limits of error in linear dimensions are first treated upon. Then follow the various methods of filling-in a survey; including the use of the compass with vertical angles, traversing, sketch contours, the plane-table and by ranging and pacing.

Chapter Eleven is upon hydrographical survey, explaining the method of determination of the shore line, soundings, the lead-line with its graduation and care and use. Charts of Boston Harbor and other points further illustrate this chapter.

Underground Topography is treated of in Chapter Twelve; large folding charts of actual surveys with copies of notes accompany this text.

Chapter Thirteen is upon the experience and ability required to convert a perspective view, on a vertical plane, into a horizontal projection.

Chapter Fourteen is upon the computation of plain areas, geodetic surveys, and the correction of errors of run and in leveling; the coefficient of refraction, and the computation of areas and volume by graphical and mechanical methods, as by lines and the use of the planimeter.

The Method of Modelling by wooden contours is explained in Chapter Fifteen; and in the last chapter the application of the topographer's work to any proposed engineering problem or project, is taken up; showing its great value in speedily determining the best and most economic location.

Nine large folding maps accompany the text; these maps are loose in a separate pocket at the back of the volume, are of a size and character well adapted to illustrate the matter referring to them. The book is filled with illustrations wherever the text will admit of it.

THE SOCIETY OF CIVIL ENGINEERS OF PARIS.

This society held their annual meeting at Paris, Jan. 4, M. Marché, the retiring President made an address.

According to custom he commenced by enumerating the members, who died in the last year, 37 in number, and also those admitted to new membership in the same period. The society is a prosperous one, the annual receipts for 1883 from its 2,037 members were 88,675 francs, and the annual expenses 66,000 francs. The surplus, which for some years past has averaged 20,000 francs, is devoted to the extinguishment of the debt upon the society's building, now nearly paid in full, and also to the founding of a reserve fund, now amounting to 82,000 francs, and lately further increased by the Gifford legacy of 50,000 francs. The library now contains 4,092 volumes, not including periodicals.

M. Marché then followed with a resumé of the papers submitted to the society in 1883. In reviewing the progress of the society in the 36 years of its existence, M. Marché remarked, that M. Faure, one of the founders of the society, divided the 500 members he addressed in 1860, into *Passive* and *Active* members; Faure deplored the fact that the number of active members was but little in excess of the same class at the time of the foundation of the society; he spoke of their lack of interest;—he pronounced the word apathy. Now 23 years later, with 2,000 members, the active list remains still about the same, and it is only the—we will not call them passive—but the listeners and readers who have increased in number. The effect of this is, that while the meetings and publications form a reservoir of work, with a never-varying level, the number of those who wish to derive nourishment from it is constantly increasing. The society has often been reproached with devoting itself too exclusively to the question of railroads; but the objectors should remember that the bulk of the member's taking an active part in its proceedings, are railroad engineers, and of all others it is the question most interesting to them.

M. Marché spoke of the organization of local engineering societies, such as those at Mulhouse, at Rouen, Lille and the Society of Mineral Industry, which gathered in the work of those members of the parent institution, who lived in their neighborhood. He recognized the effect of these local societies upon that at Paris, and while he did not censure the movement of expansion, even justified by the development of trade, he meant to investigate it. He congratulated France upon the birth of a scientific, technical and industrial press; but remarked at the same time that the greater part of these publications were inspired by the traditions of the Society; among the directors of these journals were some of the highest French engineering authorities, and they were edited, in great part, by the younger members of the French Society of Civil Engineers. Whatever effect local societies and technical journalism might have upon the future of the society, they constitute new elements in estimating the work done by its members. He appealed to those who had wandered from the

parent fold, into other societies and into the technical press, not to forget the past, but to guard the interests of the Society, and to reserve for it such of their works as were of a general or more elevated character. M. Marché did not approve of the diffusion of engineering knowledge through every possible source; that while it was well that some members should step aside an instant, to propogate and spread sound doctrines, to colonize in a manner, the majority should always remember that, for the engineering profession the Paris Society was the metropolis, the mother country.

The retiring President then introduced M. Martin, the President-elect, who taking the platform, spoke in effect as follows:

After thanking the members for the honor conferred upon him, and speaking of the society, its origin and purposes, he referred, at length, to the new conventions between the Government and the great railroad companies, to the tariff, and the factors that enter into the calculation of the taxes of transport.

M. Martin remarked in continuation, that some of the grand arteries of Paris had become notoriously unequal to the demands of travel. Of the remedies proposed, he first mentioned new streets and boulevards for the purpose of relieving the surcharged circulation upon existing avenues. Elevated roads had also been suggested; that of M. M. Faliès and Chrètien, proposed a double viaduct in iron and masonry supported upon iron columns.

This scheme, M. Martin thought was an imperfect solution of the problem, for while it provided a new method of circulation to pedestrians, it did not relieve the present streets of the overcrowding by vehicles. M. M. Heuzè and Haag proceed more boldly in the plan proposed by them; that is, they advise the laying out of new streets, or the widening of old ones, sufficiently to permit the construction of a viaduct in masonry in its centre, to support the railway; under this viaduct would be shops and stores, and on each side a street for carriages; it would constitute in fact, a system of parallel streets, separated at all points by an elevated structure carrying the railway. This project, while it is probably the most satisfactory would be an immense undertaking and would require the cutting of a path at least 100 feet wide through Paris.

A subterranean line would be without many of the disadvantages of the elevated system; there would be no obstruction to the view, no obstacles on existing streets, no comparatively important acquisition of territory, no displacement of industries; indemnities only.

But if the nature of the sub-soil is considered through which a subterranean way of the requisite section must be carried; the great number of strengthening works necessary under buildings, and the interference with sewers and existing conduits of all kinds; the question arises, whether the grandeur of the work and its cost is not out of proportion to the results attained. Moreover while the underground way would serve for the relief of the pedestrians, it would still leave the streets above crowded with vehicles, as at present. M. Martin remarked, finally, that the Parisian could not easily be persuaded to abandon, for a subterranean way, the carriages, and tramways and omnibuses that now transported him so agreeably over the surface. He did not believe such a way would be financially successful, and the whole project was likely to remain indefinitely in *statu quo*.

WASHINGTON, Feb. 1. The Patent Office has allowed a patent for a new water meter which will prove of interest in Boston, although the patent will not be formally issued and will not be accessible to the public for two weeks under the rule. The patent will be issued to Joseph E. Crisp of Somerville and is assigned to John Stetson of Newton.

PERSONAL.

THE services of Mr. S. A. Welch, who has long been identified with the meter department of hydraulic engineering, have lately been secured by the firm of Henry R. Worthington. He will hereafter represent the interests of the Worthington Meter.

WE are always pleased to see civil engineers opening offices for themselves rather than remain on salaries. It is a sign of an enterprising disposition that will almost always lead to success. The most recent accession to the ranks of the "Independents" is Mr. Walter Watson, C. E., a graduate of the Engineering Department of the Sheffield Scientific School of Yale College, who has had considerable experience in railroad and other public improvements, and in general engineering practice. He has opened an office in Pittsfield, Mass., and through his card published elsewhere solicits a general engineering patronage.

OBITUARY.

HARRY E. PACKER, President of the Lehigh Valley Railroad, and youngest son of the late Asa Packer, died at his home at Mauch Chunk, on Feb. 1. Mr. Packer was born at Mauch Chunk June 4, 1850; he graduated at Lehigh University in June, 1870, with the highest honors of his class. He immediately joined the Engineer Corps of the Lehigh Valley Railroad, and was shortly after appointed Superintendent of the Eastern and Amboy Railroad. After attaining his majority he became one of the Directors and Vice President of the Lehigh Valley Railroad. In January, 1883, upon the retirement in his favor of Mr. Charles Hartshorne, he became President of the same road, which position he held at the time of his death. Mr. Packer was also Associated Judge of Carbon Co. He leaves a widow, the daughter of the late Alexander Lockhart of Mauch Chunk.

NEW PUBLICATIONS.

HOW TO SET SLOPE STAKES. Old and New Method. A valuable pocket companion for Railroad Engineers. Keuffel & Esser, Publishers, N. Y. Price 30 cents."

Of all provoking, time-consuming work that falls to the lot of a railroad engineer, the setting of slope stakes is probably the worst. This little book presents the subject in a clearer light, in its texts and diagrams, than we have elsewhere seen it. It fully describes the old method, and gives a new method, devised by its author, for lessening the labor, and in many cases dispensing with the level altogether, after the centre cuts and fills are known.

The author, whose name is not given, has evidently studied the subject thoroughly, and by the aid of a special tape-line, which can either be home-made or purchased of the firm publishing the book, certainly decreases the labor of the engineer and deserves his thanks accordingly.

HINTS ON THE DRAINAGE AND SEWERAGE OF DWELLINGS, by WM. PAUL GERHARD, C. E. Wm. T. Comstock, Publisher, N. Y. Price, $2.50.

Mr. Gerhard, in treating of this timely and important subject, commences with household sanitation, showing what purity of soil, air and water really mean. The necessity for ventilation in rooms containing modern household conveniences is next pointed out, and also the deplorable common ignorance of the simplest requirements for health and comfort, as evinced in the faulty fittings and careless work abounding in so many of our houses. The wrong way of doing the thing is fully described and illustrated, together with the remedies to be applied.

The subject of traps is most exhaustively treated and figured; defects in plumbing work are pointed out, and a lengthy chapter or two devoted to plumbing fixtures of all kinds. The internal sewerage of houses as they should be, the general arrangement and the care of fixtures, and the removal and disposal of household wastes, are carefully explained at length and by an expert.

The author is concise and plain in his language, and experienced, and the very profuse illustration adds greatly to the practical value of the book.

The subject is of interest—vital interest to many classes, and the head of every household, the architect and builder, and the progressive plumber can all profit by its teachings.

American Institute of Mining Engineers.

The Annual Meeting of the above Society will be held Feb. 19th to 22d, inclusive, at Cincinnati, O. There will be an address of welcome by the Mayor, sessions for reading and discussion of papers, and the transaction of business; a reception, a banquet, excursions, and an Opera Festival. The programme is unusually attractive.

Members intending to be present at this meeting are requested to give notice, as early as practicable, to Mr. L. E. Warner, 13 Johnston Buildings, Cincinnati, Chairman of the Local Committee. It is highly important that the Local Committee should be able to judge how many members and ladies are to be entertained, that adequate facilities may be provided. Members desiring hotel accommodations should be prompt in giving notice as above, since the Opera Festival will bring large numbers of other guests to the city.

Negotiations are in progress to secure reduced rates of railway fares for members and ladies attending the meeting, and the results will be made known to those members who signify to the Secretary their intention to be present. For this purpose, and for such further announcements as may be required, it is desired that, *in addition to the notice given to the Chairman of the Local Committee*, members also promptly notify the Secretary at New York.

The following papers have been promised for this meeting, besides others partially promised:

"Physical Tests of Metals," by Arthur V. Abbott, New York City.

"Sulphur Determinations in Steel," by Magnus Troilius, Nicetown, Pa.

"Tables for Facilitating the Heat-Calculations of Furnace-Gases containing CO_2, CO, CH_4, H and N," by Magnus Troilius, Nicetown, Pa.

"Further Determinations of Maganese in Spiegel," by George C. Stone, Newark, N. J.

"Note on the Determination of Phosphorus in Iron," by Frank Julian, Iron Mountain, Mich.

"Note Concerning Certain Incrustations on Pig-Iron," by Frank Firmstone, Glendon, Pa., and Kenneth Robertson, Jersey City, N. J.

"The Phosphate Deposits of Canada," by T. Sterry Hunt, Montreal, Canada.

"A Silver Amalgamation Mill," by G. W. Maynard, New York City.

"The Test Commission Bill," by Thomas Egleston, New York City.

"The Benefit Fund of the Lehigh Coal and Navigation Co.," by Joseph S. Harris, Philadelphia, Pa.

The Secretary begs leave to call the attention of members to the subject of the last-named paper as one of the greatest importance and interest to mining and metallurgical industries. It is believed that many members of the Institute possess valuable experience in the matter of organizing and administering funds for the benefit of workmen, and that a comparison of opinions and results cannot fail to be generally useful. Members desiring to contribute to such a discussion are requested to notify the Secretary, and send to him their remarks in writing, if they do not expect to be personally present.

R. W. RAYMOND,
Secretary
Lock Box, 223 New York City.

CORRESPONDENCE.

STREET PAVING CONTRACTS AWARDED.

Special Correspondence Engineering News.

KANSAS CITY, MO., Jan. 31, 1884.

EDITOR ENGINEERING NEWS.—The following contracts for street paving were awarded by the Public Improvement Committee and City Engineer, Wm. B. Knight, yesterday:

MAIN ST., FROM 13TH TO 19TH.

Comstock & Halsey		2.69½	per sq. yd.
Jas. McGonegal,		2.60	" "
E. Saxton,		2.84	" "
Wm. H. Faulkner,	Kansas City,	2.69	" "
B. A. Taylor,		2.64	" "
A. J. McBean & Co.,		2.69	" "
Jaicks & Thatcher		2.72	" "

Comstock & Halsey,	(Medina, N. Y., Sandstone),	4.79½
" "	(Maine or Wiscon. Granite),	5.35
" "	(Argen., Kan., Limestone),	3.95
J. D. Hackett,	(Boulder Colo. Sandstone),	4.25
"	(Argentine Limestone),	3.40
Thos. Appleton,	(Boulder Colo. Sandstone),	4.00
"	(Arg. or Edwardsville Stone)	3.50
Michael Walsh,	(Lecompton, Kansas, "	2.70

NAME OF CONTRACTOR.	STREET.	FROM	TO	Sq. Yds. Pavement.	MATERIAL.	FOUNDATION.	PRICE PER SQ. YD.
Jaicks & Thatcher, Chicago.	Main	Second	Ninth	10500	Cedar Blocks	9" Concrete.	$2 68
Jas. McGonegal, Detroit,	"	Ninth	Thirteenth	9800	"	"	2 60
Jas. Taylor & Sons, Kansas City.	"	Thirteenth	Nineteenth	13400	"	"	2 64
John D. Hackett,	Union Avenue	Bluff St. Bridge	Hickory St.	7750	Colo Sand Stone	"	8 75
Thos. Appleton,	Mulberry	Union Avenue	Thirteenth	3500	" " "	6" Sand.	4 00

The following is a list of competing bidders:

MAIN ST., FROM 2D TO 9TH STS.

B. A. Taylor,	Kansas City,	$2.69	per sq. yd.
Comstock & Halsey,	"	2.85½	" "
James McGonegal, Detroit,		2.60	" "
E. Saxton,	Kansas City,	2.80	" "
A. J. McBean & Co., Chicago.		2.79	" "

MAIN ST., FROM 9TH TO 13TH.

Comstock & Halsey,	Kansas City,	2.75½	per sq. yd.
B. A. Taylor,	"	2.80	" "
E. Saxton,	"	2.85	" "
A. J. McBean & Co.,	Chicago,	2.77	" "
Jaicks & Thatcher,	"	2.74	" "

UNION AVENUE.

		per sq. yd.
J. R. Marsh & Co.,	(Edwardsville, Kan. Stone)	6.48
Comstock & Halsey,	(Medina, Y. Y., Sandstone),	8.53
" "	(Maine or Wiscon. Granite),	9.09
J. D. Hackett,	(Boulder Colo. Standstone),	8.75
"	(Argentine Kansas Stone),	6.90
Albion Medina Stone Co., Cleveland, O., (Medina Sandstone),		9.85

MULBERRY STREET.

		per sq. yd.
J. R. Marsh & Co.,	(Edwardsville Limestone),	$2.94
Joseph Percy & Co.,	(Boulder Sandstone),	4.25
Patrick Keating,	(Argentine "	3.15
"	(Cottonw'd, Kan. Sandstone)	3.15
Albion Medina Stone Co., Cleveland, O., Medina,		4.95

To expedite the work of paving MAIN ST., (which is one of the principal retail streets of the city,) the City Engineer and Public Improvement Committee saw fit to award the same in three sections to three different contractors, the difference in price being very small, which action, on the part of the Engineer, received the hearty endorsement of the property owners on the street. "J. A. T."

SOUTH AMERICAN NEWS.

Special Correspondence Engineering News.

178 DEVONSHIRE ST., BOSTON, Jan. 28, 1884.

EDITOR ENGINEERING NEWS.—I noticed in ENG. NEWS recently, an inquiry for R. R. notes from Argentine Rep. I might furnish something in this line as I receive papers and letters from Buenos Ayres every fortnight. I send notes that I have had copied from two of the last papers. I cannot send you clippings as the papers are sent to numerous friends. Yours truly,

EDW. P. ADAMS.

[We publish elsewhere the extracts kindly sent us by Mr. Adams.—ED. ENG. NEWS.]

ALUMINUM TAPES.

Special Correspondence Engineering News.

2135 SPRUCE ST., PHILA., February 4, 1884.

EDITOR ENGINEERING NEWS.—If no one gives a better reply to the question of Mr. G. W. Pearson's in the last number of your paper in regard to the use of aluminum or aluminum bronze for tape measures, you might state that at a late meeting of the Engineers Club of Philadelphia, a piece of tape of phosphor-bronze was exhibited, which was stated to be satisfactory except in regard to one very important point, which was, that it was peculiarly liable to become kinked, and the kinks could not be properly straitened again, and that it continually becomes shorter. Perhaps, however this would not be the case with aluminum bronze. Very truly yours.

T. M. C.

OUTFIT FOR A RAILROAD SURVEY.

Special Correspondence Engineering News.

DENVER, COL., Feb. 1, 1884.

EDITOR ENGINEERING NEWS.—Fitting out a party for an extended railroad survey is a matter of great importance. Can you tell me which of the several Engineer's Pocket Books gives the best details of such an outfit, and oblige. Yours truly,

CHIEF ENGINEER.

[There is *no question* as to the superior merits of Cleeman's R. R. Engineer's Practice in this as well as in many other points of practical interest to Engineers. A list of articles required for "camping out" has been contributed to the volume through the courtesy of Mr. E. D. T. Myers, of Richmand, Va., one of the best known and most experienced railroad engineers of this country; this list occupies two and one-half pages of the book, and includes also, the regulations as to rations of the U. S. Army, and the list of supplies sent out in the Collins' engineering expedition to Brazil.—ED. ENG. NEWS.]

BRIDGE LETTING.

Special Correspondence Engineering News.

OFFICE OF AUDITOR OF CASS COUNTY, }
LOGANSPORT, IND., Feb. 5, 1884.

EDITOR ENGINEERING NEWS.—The names of the Bridge Companies bidding on the 18th St. Wrought-Iron Bridge advertised in ENGINEERING NEWS, are as follows: Penn Bridge Co., Beaver Falls, Pa.; Smith Bridge Co., Toledo, Ohio; Massillon Bridge Co., of Massillon, Ohio; Morse Bridge Co., of Youngstown, Ohio; Mt. Vernon Bridge Co., Mt. Vernon, Ind.; Indianapolis Bridge Co., Pittsburgh Bridge Co., Wrought-Iron Bridge Co., of Canton, Ohio; Western Bridge Co., Fort Wayne, Ind.; Shiffler Bridge Co., Pittsburgh, Pa.; Berlin Iron Bridge Co., East Berlin, Conn.; Lomas Forge and Bridge Co.; King Iron Bridge Co., Cleveland Iron Bridge Co., Columbia Bridge Co., Dayton, Ohio; Caldwell & Lane, Newark, O.

The WROUGHT-IRON BRIDGE CO., OF CANTON, OHIO, W. W. WINSLOW, AGENT at Indianapolis, got the contract at $32.33 per lineal foot.

H. TORR,
Auditor.

IRVINGTON WATER WORKS.

Special Correspondence Engineering News.

IRVINGTON-ON-HUDSON, N. Y., Feb. 3, 1884.

EDITOR ENGINEERING NEWS.—Replying to yours of the first inst., I submit below the names and addresses of the bidders for Irvington reservoir: W. M. Martin, 50 Wall St., New York; Geo. M. Cushing, Box 1800, New York City; Jno. Quinn, Tarrytown, N. Y.; Cornelius Halpin, Tarrytown, N. Y.; Jno. Harrison, Yonkers, N. Y.; Murphy & Gory, Irvington, N. Y. The contract was awarded to Inman Bros., of 32 Liberty St., N. Y.

Very truly
GEO. H. PEARSON, ENG.

MINE SURVEYING.

Special Correspondence Engineering News.

PITKIN, COLO., January 25, 1884.

EDITOR ENGINEERING NEWS:—I have had considerable underground work to do in the mines here, which are principally silver. I tried to ascertain whether there was any standard work on underground mining, and was told "Subterranean Surveying," Weale's rudimentary series, was the only work on that subject. It may well be termed "rudimentary," for as a school book I should not recommend it, and as a work for a practical underground engineer it is valueless. It treats of surveying by the needle and by the magnetic course, a system antiquated enough, but almost worse than useless if not impossible here on account of local attractions. The transit table is only given to degrees and is therefore useless. Can any of your readers inform me if there is any book on underground work, as I myself have been unable to find any. In fact I do my underground work and meet whatever difficulties I have to encounter in its prosecution by my own methods, and have hitherto come out most satisfactorily. I surveyed the other day the most crooked mine in the State, "The Silent Friend." Yours truly,

R. A. SKUES, C. E.,
U. S. Dep'y Mine Surveyor.

[The Ohio *Mining Journal*, (devoted to coal mining, mostly,) is a very practical magazine, issued quarterly by the Ohio Institute of Mining Engineers. Price, $2.00 per year. Address Andrew Roy, State Inspector of Mines, Columbus, Ohio. Vol. 1, No. 1, has an article on "Practical Mining Surveying," by R. S. Paul, M. E. The *Mining Herald and Colliery Engineer* is a good paper, published at 108 S. Main St., Shenandoah, Pa. Weekly, $2.00 per year. ED. ENG. NEWS.]

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.: M. INST. C. E.

(*Continued from page 45*)

DXC.—READING, PA.

Reading, Pennsylvania, in lat. 40° 20' N. lon. 75° 50' W. is on gently sloping ground on the east bank of the Schuylkill River. Settled in 1748, it was incorporated a city in 1847. Water-works were built by a private company in 1819, taking the supply from three large springs. The works have been enlarged from time to time and were bought by the city in 1865. The supply is now drawn from the original springs and the Bernhart and Antietam Creeks, on which masonry dams are built, forming storage reservoirs. Bernhart reservoir receives the drainage of 2 square miles and is 7 acres in area with a depth of 18 feet at the dam, holding 17,000,000 gallons.

Antietam lake receives the drainage of 5 square miles, covers 18 acres, with a depth of 35 feet at the dam and holds 90,000,000 gallons, at 152 feet above the distributing reservoirs in the city, to which the water is conveyed by 3½ miles of cast-iron pipe from 36 to 10 inches diameter. There are two distributing reservoirs, the Hamden, holding 30,000,000 gallons and the Penn St., holding 5,500,000 gallons about 90 feet above the city.

Distribution is by 35 miles of cast-iron pipes of 24 to 4 inches diameter, with 400 fire hydrants and 8,300 taps. About 30 meters are in use. Services pipes are chiefly of iron with some of lead. The population in 1880 was 43,280. The daily consumption in 1883 was about 3,000,000 gallons. The city paid $300,000 for the works in 1865. Their estimate value now is $1,100,000. The bonded debt is $479,125 at 4, 5 and 6 per cent interest. The expenses of operation in 1882 were $39,673,19 and the receipts $78,588.92. There were also expended on extensions, $42,865.94.

The works are managed by a board of four water commissioners, F. S. Jacobs is President of the Board. W. B. Harper is the Superintendent.

DXCI.—LONG BRANCH, N. J.

Long Branch, New Jersey in lat. 40° 12' N. long. 74° 5' W. is on level ground on the Atlantic coast about 30 miles south of New York City and is one of the principal summer resorts of the United States. It takes its name from a brook which is a branch of the South Shrewsbury River and was formerly a fishery of the Indians who held the land until about 1750. It has long been a favorite watering place, but principally since railroad communication was opened with New York in 1875. Water-works were built in 1879 by a private company taking the supply from Whale Pond Creek, which drains about 8 square miles of flat country. There is also a well 30 feet in diameter and 15 feet deep. The water is pumped into a plate iron stand pipe, six feet in diameter and 75 feet high by two Worthington steam pumps. The well which is sunk in yellow sand and gravel, yields about 70,000 gallons per day. Distribution is by 8 miles of cast-iron pipes of 16 to 4 inches diameter with 50 fire hydrants and 250 taps. The population resident in 1880, was 3,833, but in "the season" is nearer 50,000. The daily consumption varies from 250,000 to 1,000,000 gallons. The works cost $100,000. No returns of expenses and receipts are obtainable. Louis B. Brown is President of the company, Thomas W. Cooper is the Superintendent.

CORRECTION.—*Norwalk*, Conn., p. 21. The Water Commissioners of the Borough of Norwalk are Winfield S. Moody, Charles E. St. John and Joseph E. Shepherd. The Hon. Dudley P. Ely is one of the Water Commis-

sioners of the City of South Norwalk, the waterworks of which were described in ENGINEERING NEWS of July 29, 1882, p. 262.

ACKNOWLEDGEMENT.—The statistics of the Reading, Pa., water works have been kindly furnished by Mr. Albert R. Durham, and those of Norwalk, Conn., by Mr. George W. Cram. Frequent efforts to procure information directly from the officers of either of these works during the past three years, have failed to get any reply. There are still eleven cities of over 10,000 inhabitants from which no replies to letters asking information can be obtained. Any information regarding these water works will be gladly received. They are as follows: Mobile, Ala., Chester, Pa., Newburyport, Mass., San Jose, Cal., Canton, Ohio, Galesburg, Ill., Austin, Tex., Chillicothe, Ohio, Shenandoah, Pa., Columbus, Ga., Columbia, S. C.

Engineer's Club of Philadelphia.

At the regular meeting on the 19th ult, Mr. Wilfred Lewis read a paper upon the "Resilience of Steel," reviewing some of the means employed for the storage of energy, and showing the place occupied by steel among them.

Among the means now employed, compressed air, hot water and the storage battery were cited from an English writer as being about equal in value and giving out about 6500 ft. lbs. of work per pound of material used.

Steel springs, according to the same writer, were said to yield about 18 ft. lbs. per pound. In this connection, the project of using steel springs as a motor for street cars was referred to as the most hopeless of all possible means of locomotion.

To test the accuracy of this statement in regard to steel, several experiments were made by the writer upon tempered specimens, both for tension and flexure. Contrary to expectation, the highest results were shown by the flexure of a small spiral clock spring weighing 2040 grains, which gave out, when wound up, 45 ft. lbs. of energy, or in other words, 154 ft. lbs. per pound.

The transverse strength of this teel within the elastic limit was found to be about 300,000 lbs. per sq. in., and its modulus of elasti ity about 30,000,000. Such extraordinary strength, with such a low modulus, was so far beyond conjecture that it seemed to give a new hope for the success of the project referred to; but after making the necessary allowances for weight of car and efficiency of driving mechanism, it was found that no more than about 20 ft. lbs. per pound of car would be available for locomotion. It was th refore improbable that such a car could ascend a hill over 20 feet high.

It was also a matter of doubt whether large springs could be made o show results which would even approach th se figures, and on this account he experiments about to be tried might be looked for with some intrest.

Mr. H. C. Luders presented a description illustrated by photographs, of the ancient ship found near Sandefjord, in Norway.

He also exhibited specimens of rolled and annealed phosphor-bronze of maximum ductility, consequently of minimum tensile strength, and submitted the following data of the test thereof: length, 2"; diameter, 0.57"; subjected to a strain of 13,620 lbs., equivalent to 53,400 lbs. per sq. in.; elongation, 70,5 per cent.; reduced area at point where fracture would occur, 8.3"; elastic limit, about 18,000 lbs. per sq. in. Hard rolled rods tested without turning off the surface, have shown a tenancity exceeding 90,000 lbs. per sq. inch.

The Use of Lime Cartridges in Coal Mines.

At the Meeting of the Manchester Geological Society, on Nov. 13, a paper was read on the use of lime-cartridges in coal mines, which described the process that had been adopted by Messrs. Smith & Moore, at their Sheplay collieries, Derbyshire, where the use of powder has been prohibited after a disastrous explosion in their mine. The great cost of wedging the coal induced Messrs. Smith & Moore to experiment with the view of utilizing the expansive power of lime as an efficient agent for breaking down coal, and the result has been most successful. They had been enabled to secure absolute immunity from danger of explosion of gas; greater safety in the working places, as it was unnecessary for the workmen to retire while the charges were being exploded; economy of timber, as the roof was in no way affected or shaken; a very much greater percentage of round coal; while the collier was enabled to work not only without the laborious process of breaking down the coal by wedges, but avoided the numerous accidents consequent upon their use. In the manufacture of the cartridges nearly pure carbonate of lime was used; this was compressed by hydraulic power, and the die by which the cartridges were formed was two and one-half inches in diameter and seven inches in depth. A pressure of forty tons was applied simultaneously at both ends of the column, which was reduced from seven inches to four and one-half inches in length. The cartridge was then wrapped in paper, and was ready to use in the mine. For drilling the holes in which the cartridges were placed, a light boring machine was used, the holes varying according to the hardness of the coal, the average depth of the holes being three feet six inches, and the distance apart four feet six inches. The drilling occupied from twelve to twenty minutes, and the cartridges were then placed in the back of the hole, groove uppermost; a tube having six perforations, about four inches apart, was inserted, the hole was stemmed up, and a quantity of water was forced in by means of a small hand pump. The generation of the steam and expansion of the lime commenced almost immediately after the water reached the cartridges, and the time taken by the lime to bring down the coal varied, according to hardness and position of the seam, from fifteen minutes to three-quarters of an hour. It had been stated that the heat produced by the slaking of the lime was sufficient to ignite gas, but this had been altogether disproved by special experiments made for that purpose.

Cape Cod Canal.

The Committee on Harbors and Public Lands, Mass., Legislature, gave a hearing on Tuesday on the petition of the Cape Cod Ship Canal Company for alterations and additions to its charter, the changes requested being to remove ambiguity in the wording of the charter, to change the route and location as may be authorized by the Railroad Commissioners, and for definite restrictions as to the number and manner of highways and ferry crossings. Mr. George A. King appeared for the citizens of Sandwich, Richard Olney, Esq., for Mr. Lockwood the contractor and builder, and General William Cogswell for the canal company, while the opposition, the Old Colony Railroad Company, was represented by Col. J. H. Benton, Jr. Mr. King in opening reviewed the history of the enterprise at length, and said that all that was asked was legislation to make matters go without friction anywhere between the company and the people residing in the immediate vicinity of the canal. Gen. Cogswell followed to this effect, explained the nature of the proposed change in location, which will straighten the route and shorten it to a slight extent. He introduced the testimony of Messrs. Chase and Thompson, engineers of the company, and of many citizens of Sandwich. The committee continued the hearing to next week.

WASHINGTON, D. C., Jan. 26.—The Secretary of the Treasury approved the following rule, adopted by the Board of Supervising Inspectors of steam vessels at its present session:

Plates of iron or steel used in the construction of boilers extending beyond cylindrical shell to the front of the boiler over furnace shall extend at least 12 inches below the center of the shell, and shall not be of less tensile strength and thickness than the adjoining portion of the shell.

This rule, which leaves all flat surfaces, legs, heads, etc., to be determined by local inspectors, was adopted as a substitute for a former rule on the same subject:

THE New York and Boston Inland Railroad Company, which some time since started out with a project of wonderful proportions for an air line between Boston and New York, is now a thing of the past, so far, at least, as its corporate existence in Connecticut is concerned. By the provisions of its charter in that State the Company was required to expend 10 per cent. of its subscribed capital in construction work before February 4, and having failed to comply with this condition its charter was forfeited Monday.

THE Committee on Water Supply of Massachusetts Legislature heard the petitions of W. F. Ward and others of Hyde Park for further water supply for that town. Mr. J. B. Richardson asked for the insertion of provisions to protect the town against possible negligence or bad faith on the part of the incorporators, and the town of Canton asked for protection in its rights in case the Hyde Park supply should be taken from sources other than now used.

NEWS OF THE WEEK.

Water, Gas and Steam.

THE special attention of water works contractors is drawn to proposals for the Troy, Ohio, Jackson, Tenn., and Boston, Mass., Water Works, advertised in another column of this week's issue.

THE question of water works for Calais and St. Stephen, N. B., is being quietly agitated by the local press. The protracted drouth of last summer and the great scarcity of water at that time has stimulated the friends of the enterprise to renewed exertions. The prospects for the introduction of the Water Works system on the St. Croix River seems brighter than ever before.

MASS. WATER SUPPLY—By Mr. Whitcomb of Watertown, a bill to supply the town of Watertown with water from the Charles River, or from any other source within the town limits, at a cost of not more than $250,000, the act to take effect when accepted by a majority of the votes cast in regularly convened town meeting.

By Mr. Frisbie of North Andover, a bill authorizing the town of Middleboro', by a two-thirds vote of its citizens in town meeting assembled, to provide for its inhabitants a water supply at a cost of not more than $75,000.

LOCK HAVEN, Pa., has been recently experimenting, through its Water Committee, with meters. The result of the investigation shows that one large consumer who, at 16 cents per 1,000 gallons, should pay $837.36, now only pays $80; another pays $50 who at the above rate should be taxed $597.12. On the other one reverend gentleman who, by meter, uses eighty-two cents worth of water per annum, pays $6 for the privilege.

THE Selectmen of Nahant, Mass., have reported that the entire work of piping the town for the new water service and the placing of hydrants could be performed for $65,000. There would be needed 50,400 feet of pipe of various sizes from 2 to 10 inches in diameter, and for this R. D. Wood & Co. of Philadelphia were the lowest bidders at $19,000. The committee on a source of supply have reported progress, and that it was thought that the Lynn water works would be completed before June and that it would be found that Lynn could supply Nahant. The water pipes are to be laid in Nahan as soon as possible.

MR. CHARLES H. DREW, Chairman of the Selectmen of Brookline, Hon. Thomas Parsons and Hon. William Aspinwall, also of that town, asked the Committee on Water Supply of the Mass. Legislature to authorize the issue by that town of additional water bonds to the amount of $100,000, its present authorized water debt being $600,000, of which $592,000 have been expended. Additional money, it is stated, is needed to provide a high service by which about one-third of the town is to be supplied. Mr. George Greggs objected to authorizing the borrowing more money for this purpose; he took the ground that it should be raised by direct taxation.

Mr. J. D. Shipper, for himself and his associates, requested the committee to grant an act of incorporation to the Holliston Water Company, which is to have a capital of $50,000, and the right to issue bonds to the amount of $40,000.

PITTSFIELD, Jan. 28.—Lucky Byron Weston of the Long and Weston dynasty in the State Government and maker of "the best linen ledger paper in the world," according to medals and diplomas and certificates and awards from Philadelphia, Paris, Boston and other competitive shows, including the Berkshire Agricultural Society, has struck another streak in his perforations of the bowels of the earth for spring water for his mills. One artesian well, lately completed, gave him a very satisfactory result of 250 gallons of pure spring water per minute. Starting again, in another locality, he has found another vein at a depth of 200 feet that flows 400 gallons a minute of pure spring water for his paper making operations, and paper manufacturers will understand what a bonanza all this is. The wells cost about $2000 each, possibly more, and certainly not less, but if you should ask the ex-Lieutenant Governor what he would close them up for you would be astonished at the sum he would demand as their value to him. The local query is, where does the water come from? Are their subteranean lakes waiting for air holes, or is the supply now found the tapping of the underground flowage of the mountain ponds toward the valley streams. There are many who believe that these flowing wells which Mr. Weston's enterprise has secured will have their effect on spring-fed brooks and lakes located higher than the Dalton Valley. These chance borings, with the results obtained, may be of a good deal of importance in the much discussed

question of why the water supply seems to be annually lessening. At any rate the Weston wells are surprising, and are as valuable as oil wells or ore beds to Weston's mills.—Correspondence of the *Boston Journal*.

Streets, Drainage, Sewerage, Etc.

A DISINFECTING tank for the disposal of sewage has been patented by Mr. James J. Powers, of Brooklyn, N. Y. It combines with a settling tank another one for disinfecting and a small one for receiving the disinfecting liquid, the latter arranged for automatically discharging the disinfecting liquid into the disinfecting tank. The fluids are withdrawn from the latter by a siphon, the outer end of which has an automatically closing valve, and is in a smaller tank connected with absorption or drain tiles.

WORK is commenced on a sewer system for Coney Island. The sewage will be pumped into a cesspool at the western end of the island. After deodorization, it will be pumped on to a drying shelf, and the liquid will be perfectly clean, it is claimed, and then it will be turned into Gravesend Bay. The residuum will be converted by the drying process into a fertilizer capable of being packed in bales for shipment into any part of the country.

Contracting Miscellany.

ALBUQUERQUE, Jan. 29.—The contract for the new hotel in this city was let to-day to M. Scott for $52,635. There were four bids from Denver—the E. F. Halleck Lumber Company, Harvey & Washburn, Captain Roberts, and Mr. Rundle.

STILLWATER, MINN. Jan. 31.—The prison inspectors and officials met here to-day and decided to at once rebuild the workshop, 60x150, being half the capacity of the main shop, which is to be completed by the Northwestern Car and Manufacturing Company. The bidders were S. C. Cutter, Minneapolis; L. Bisbee & Co., Minneapolis; Northwestern Car and Manufacturing Company, Stillwater, and Lutz & Alexander of Wabasha. The latter underbid their competitors and secured the contract for $17,874. Their original bid was $19,874, but they allowed $2,000 for the material on the ground, making the price as above stated. The new structure, which is to be brick with iron roof, will be three stories high with a basement. It will be completed as soon as possible. A. M. Radcliff, the prison architect, was also instructed to prepare plans for the new offices of the main prison building, which will be fire-proof, and for an iron roof over the cells. As soon as these have accepted by the inspectors, bids will be advertised for.

THE following is a partial report of City Engineer Ed. Wasell of Winnipeg, in reference to the tenders received for the block paving or gravelling of Main Street:

To the Chairman and Members of the Committee on Works:

GENTLEMEN,—The accompanying statement of the tenders for paving the streets is respectfully submitted.

Messrs. Munro and Sinnott's tenders are based upon specifications and plans prepared in this office.

Messrs. Brydon & Williams' tenders are based upon plans and specifications prepared by themselves.

Mr. Brydon's specifications provide for a substantial stone curbing, which, in this respect, is superior to any other.

Mr. Williams' specification does not mention any curbing and requires the city to provide the gravel pit at Bird's Hill and construct a siding thereto.

In the matter of the relative merits of the various kinds of paving and gravelling, I have always believed that a good cedar or tamarac block pavement will give better satisfaction and be more economical than other for Main street. In my annual report, submitted to the Council on the 28th of December last, I stated: "With regard to gravelled streets, I quite agree with the *Engineering and Mining Journal*. They answer very well for parks and streets where pleasure driving is the main use made of them; but they are not suited for heavy traffic on business streets." If it were necessary, I could back up this opinion by many civil engineers who have had practical experience in road and street making both in the United States and Canada.

Railroads.

The Japanese Government has issued a a new loan of $18,500,000 for railway construction, which is redeemable in thirty years at annual drawings.

GEN. ANDERSON, chief engineer of the Northern Pacific, has advertised for proposals for building sixty miles of the Cascade branch, from the present end of the track, twenty-five miles west of Wallulla, to Yakima City, W. T.

CHICAGO, Jan. 26.—Articles for the incorporation of the Cincinnati and St. Louis Railway Company were filed to-day. The capital is $3,000,000. The incorporators are L. D. Saxton, of Hillsboro, D. D. Fisher, A. B. Seward, of St. Louis, Jean Webb and H. H. Homer of Lebanon. The object of the company is to build a line of railroad from East St. Louis to a point in Crawford County.

HARRISBURGH, Penn., Jan. 25.—A charter was issued at the State Department to-day for the Pittsburg, Knoxville and Beltzhoover Railroad Company, the line of which will extend from Pittsburg to Knoxville, a distance of two miles The capital is $100,000.

A FEW weeks ago the Panama Cana Company loaned the Republic of Colombia 2,500,000 francs, and authorized the Secretary of the Treasury by cable to draw for that amount. He drew for 2,000,000 francs in excess, and the rafts were protested in Paris. By cable he has asked the Canal Company to honor the extra amount. The messages in relation to the affair have already cost $3,000 and no definite result have been obtained.

BOZEMAN TUNNEL.—Trains commenced running through two weeks ago. The tunnel is 3,610 feet long, 17 feet wide, and 21 feet high in the centre. Work on the approaches commenced in the fall of 1881, and on the tunnel proper in the spring of 1882. Total cost $300,000. The route through the tunnel will make a difference of two miles in distance, and fully an hour in time. It reduces the grade 95 feet per mile. The maximum grade over the range is now 116 feet per mile.

A CONSTRUCTION Company, with $1,000,000 capital will at once commence building a road 85 miles long, broad guage, from the Memphis and Charleston Railroad from some town on Georgia Pacific Railroad, southwest of Birmingham to Sheffield. This last is a new city which is to be built by a syndicate, on the head of navigation of the Tennessee River. Jere Baxter, President of the First National Bank of Nashville is President of the Construction Company. Major Sample has already made a preliminary survey of the Railroad route.

SIR JOSEPH BAZALGETTE has appended to the published report of his address a carefully compiled table giving a large amount of statistical and other information about the chief cities of the world. The 31 gallons of water per head supplied to London compare unfavorably with the 73.3 gallons used in Boston, Mass., the 60½ in New York, and the 54.15 in Philadelphia, though the return for the latter city adds "that nearly half is wasted." Chicago, which has the unparalleled reservoir of Lake Michigan close at hand, gives each of its citizens 102½ gallons a day, while the District of Columbia, which consists of Washington, Georgetown, and the surrounding country, has 143 gallons per head per day. All the American and Canadian cities thus possess a profusion of water which puts our London supply to shame. On the Continent, Rome has the lead. From its four sources the city supplies 106.38 gallons a day of spring water for each inhabitant; Marseilles comes next with 158.4 gallons from the river Durance; while Hamburg pumps from the Elbe 45½ gallons per head, and Paris 36. Berlin, on the contrary, is content with 13.3. There is, therefore, no reason why Londoners should be in any way restricted in the use of this prime necessary of cleanliness and life.—*London Daily News.*

THE MAGNITUDE OF THE CANADIAN PACIFIC RAILWAY SYSTEM.—By leasing what is known as the Ontario and Quebec system, the following roads will be under the control of the Canadian Pacific Railway syndicate.

Toronto, Grey & Bruce division, Toronto to Owen Sound, 122 miles; Orangeville Junction to Teeswater, 70 miles. Total, 192 miles.

Credit Valley division, Toronto to St. Thomas, Streetsville to Orangeville, Church's Falls to Elora. Total, 183½ miles.

Ontario & Quebec, Toronto to Perth, 200 miles.

Making a total of 575½ miles already built.

The London Junction Railway, under construction from London, a distance of 12 miles.

The projected railway from Smith's Falls to Montreal, 125 miles.

In all, completed, under construction and projected, 712½ miles.

These roads give the Canadian Pacific the railway monopoly covering the whole of the northwestern part of Ontario, and where it controls the Northern Railway from Toronto to Collingwood, which is to be its connecting link at Callendar with the Northwest, system, it will have the only two roads running direct from Ontario to Lake Huron, to connect with steamers for the Northwest via Port Arthur, Lake Superior.

IRON, METAL AND COAL MARKETS.

PHILADELPHIA, Feb. 8, 1884.

There is a steady improvement to be noted in the tone of the eastern Pennsylvania iron trade. Sales have not been on as large a scale as makers wish, but have been better than for former weeks. Pig Iron prices are generally steady; the drop of the Andover and Glendon companies to $18 for their special brands caused some uneasiness at first, but there are now no general apprehensions of a decline, as most brands of iron are selling very near cost. Most of the Forge Iron sold, commands about $18, though inferior grades have been bought at $17.50. Foundry Iron ranges from $18.50@$19.50 for No. 2, and from $20@$21 for No. 1.; foundry prices are steady and demand moderate. Several recent bids for foreign irons have been withdrawn. Some sales have been made, but at private terms. Bessemer is quoted at $20, but would sell at $19.50; Spiegeleisen, $29 for 20 per cent. asked. Sales of 2500 tons of Structural Iron for cable road requirements, are reported, and there is a large amount of work in sight. Plate Iron is very low and in only moderate demand. Nails are held more firmly at $2.50@$2.60, with offers for large lots at $2.40. A sale of 3000 tons of Old Rails is reported for shipment from a New England port to Wilmington, Del., at about $23. Small lots command about $23. Steel Rails are quoted at $35@$36 at mill; numerous small sales at the latter figure are reported, but the large buyers are holding off for lower prices. The business in Merchant Bar is more active, and there is every indication that demand from this time out will be active; but prices are weak, and still show a declining tendency. 1.90@2c. is paid for refined, with a little more for small lots from store.

PITTSBURGH, Feb. 8, 1884.

There is some improvement in the volume of business transacted in Iron and Steel, and a better feeling prevails, but prices remain unchanged. Mills and furnaces are working fuller and the resumption of some more of the idle furnaces will soon be announced, but consumers show no disposition to buy ahead. Numerous sales of forge are reported, mostly in about 100 ton lots, at $17@$17.50. Foundry ranges from $18@$21. Bessemer is held at $21@$21.50; Muck Bar is quoted nominally $32, but no sales can be reported. Manufactured Iron is selling fairly at 1.70@2c., according to quality and size of order; manufacturers think that business will begin to be more active in a week or two, but prices are no better. Nails are firmer, and offers at $2.35@$2.40 are reported, but $2.50@$2.60 is held in small lots. The pipe mills are busy, and orders are coming in slowly. The price list remains as previously reported. Steel Rails are quoted at $35@$36 with a good business in small lots being done. The Coke syndicate has fallen through, owing to the impossibility of securing unity of action among large owners. The glass works will be in operation in a few days, the fires all being lighted. The demand for glass all through the West is very heavy, and the outlook for a good trade is very bright. It is not known when the bottle blowers will start up again.

CHICAGO, Feb. 7, 1884.

There has been a marked improvement in both demand and inquiry during the past week. Stocks are everywhere depleted, and consumers are at last forced into market to supply themselves. Manufacturers feel greatly encouraged, and though prices have not improved noticeably, it is thought that an advance in some lines is not far off. Mill owners report a slightly firmer feeling in prices, and a better movement. Bars are steady at $1.90 for common and $2@$2.10 for refined, with considerable concessions on round lots. Structural Iron is quiet, at $2.50@$2.60 for Tank.' $2.70 for angles; $3.60 for Beams. Galvanized Iron is in good demand for the season. Quotations unchanged. There is no demand for Russia Iron; Norway and Swedish are quiet. Nails are in better request, and spring inquiries are being presented. Car load lots can be had at $2.50, with $2.55@$2.60 asked for small lots. Steel is more active. The Steel Rail mills are holding more firmly to prices, while large buyers are holding off, insisting on December prices which mills decline to accept. Quotations are $35@$36, f. o. b. Southern Pig Iron is in increasing demand, with increasing stiffness of prices. Foreign irons are in light stock and dull demand.

COAL.

PHILADELPHIA, Feb. 8, 1884.

The rapid depletion of stocks at shipping points and in consumers hands, caused by the cold weather and the increase in manufacturing demand, has led to a good deal of talk as to return to full time, and a good many operators are in favor of it, but it is probable that the companies will agree to fulfill their original intention and adhere to the restriction policy. There is a relative scarcity of the smaller sizes; the domestic demand has been very heavy, and manufacturers have been using more of the smaller sizes than they usually have. Bituminous coal is also being used in the place of the larger sizes and this contributes to their dullness. The Reading Company mined last week, 178,000 tons of coal. The total production for that week was 436,615 tons, and for year, to same date, 1,607,279 tons. The Pennsylvania Railroad carried, for week ending January 26th, 235,351 tons of coal and coke. Vessels are scarce at Port Richmond, and freights are $1.50@$1.60 to Boston. The Bituminous Coal trade is very dull, and no improvement is probable for some time to come, although operators think that the placing of the large contracts will have a good effect on prices.